(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－346356

(43)公開日　平成11年(1999)12月14日

(51)Int.Cl.⁶	識別記号	ＦＩ		
Ｈ０４Ｎ　7/18		Ｈ０４Ｎ	7/18	Ａ
				Ｈ
5/00			5/00	Ａ
7/00			7/14	
7/14			7/00	Ｚ

審査請求　未請求　請求項の数24　ＯＬ　（全 28 頁）　最終頁に続く

(21)出願番号　特願平11－91618

(22)出願日　平成11年(1999)３月31日

(31)優先権主張番号　特願平10－85706

(32)優先日　平10(1998)３月31日

(33)優先権主張国　日本（ＪＰ）

(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地

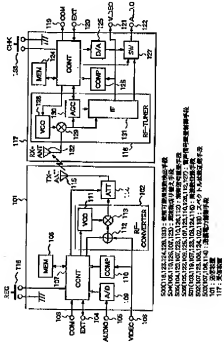
(72)発明者　桐野　秀樹
香川県高松市古新町８番地の１　松下寿電子工業株式会社内

(72)発明者　平賀　哲雄
香川県高松市古新町８番地の１　松下寿電子工業株式会社内

(74)代理人　弁理士　早瀬　憲一

(54)【発明の名称】　伝送装置および伝送方法

(57)【要約】
【課題】標準テレビジョン放送の受信機能も有し、微弱電波を使用し、将来のデジタルテレビジョン放送や移動体通信機器が同帯域を使用しても共存可能な、安価な伝送装置を提供するものである。
【解決手段】標準テレビジョン信号によるＲＦコンバータ１０２とＲＦチューナ１１８を使用し、受信帯域内で使用可能な周波数を検出し、周波数を高速に切り換えてスペクトルを拡散して微弱電波で通信する構成とした。



【特許請求の範囲】

【請求項１】　微弱電波を利用して映像または音声を伝送する発信局と、
微弱電波を利用して映像または音声を伝送する着信局と、
前記微弱電波の到達距離を超えて配置した前記発信局と着信局との間に配置した中継局とを備え、
前記発信局からの送信信号には、映像や音声などの本来の情報に加え、着信局の宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含み、
前記中継局は、前記発信局から受信した微弱電波の周波数とは異なる周波数に変調して出力するとともに、
着信局側から自局が受信する周波数の情報を付加して送信し、
前記着信局は、自局宛の信号であることを認識すると、前記中継局の指定した周波数に微弱電波を変調して映像や音声を送信することにより、発信局と着信局との伝送路を確立することを特徴とする伝送装置。

【請求項２】　請求項１記載の伝送装置において、
前記発信局から前記着信局へ向けた往路の送信信号には、標準テレビジョン信号を使用し、
映像信号の垂直帰線消去期間に、ＰＣＭ音声信号と着信局の宛先や自局の指定する受信周波数を示す情報を重畳したことを特徴とする伝送装置。

【請求項３】　標準テレビジョン信号を発生するＲＦコンバータを備えた送信装置と、
標準テレビジョン信号を受信するＲＦチューナを備えた受信装置と、
使用に先立って前記ＲＦチューナの受信帯域内で映像伝送に使用可能な周波数を検出する使用可能周波数検出手段と、
検出した周波数を通信周波数リストとして前記送受信装置双方に登録する検出周波数登録手段と、
前記通信周波数リストの範囲内で周波数を切り換えることにより電力スペクトルを拡散して通信を行うスペクトル拡散通信手段とを備えたことを特徴とする伝送装置。

【請求項４】　請求項３記載の伝送装置において、
単位帯域幅当りの電力密度が一定になるように、前記通信の際の送信電力を使用周波数帯域幅に応じて自動的に変化させる送信電力制御手段を備えたことを特徴とする伝送装置。

【請求項５】　請求項３または４記載の伝送装置において、
映像信号の同期タイミングに同期して前記通信の際の周波数を切り換える周波数切り替え手段を備えたことを特徴とする伝送装置。

【請求項６】　請求項３ないし５のいずれかに記載の伝送装置において、
前記通信の際に、制御信号を帰線消去期間の映像信号上に重畳して伝送する制御信号重畳伝送手段を備えたことを特徴とする伝送装置。

【請求項７】　請求項３ないし６のいずれかに記載の伝送装置において、
前記通信の際に、音声信号をＰＣＭ化し、帰線消去期間の映像信号上に重畳して伝送する音声信号重畳伝送手段を備えたことを特徴とする伝送装置。

【請求項８】　それぞれ請求項３ないし７のいずれかに記載された伝送装置からなる第１および第２の送受信装置と、
前記通信の際に、前記通信周波数リストの範囲内で周波数の高い方から低い方、もしくは低い方から高い方へ単一方向に周波数切り換えを行なうとともに、周波数が前記周波数リストの最後に達した時は前記周波数リストの最初へ戻すように周波数切り換え順序を制御する周波数切り替え順序制御手段と、
前記第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間割を用いることにより、複信で通信を行うように制御を行う通信制御手段とを備えたことを特徴とする伝送装置。

【請求項９】　請求項８記載の伝送装置において、
前記通信の開始時には事前に登録してある前記通信周波数リストを使用し、通信開始後は前記通信周波数リストを複製した第２の通信周波数リストを使用するとともに、通信の良否結果情報を前記２組の送受信装置間で交換することにより前記第２の通信周波数リストを随時更新する通信周波数リスト更新手段を備えたことを特徴とする伝送装置。

【請求項１０】　請求項３ないし９のいずれかに記載された伝送装置において、
製造時に伝送装置に付加される識別番号（以下、ＩＤと称す）を記憶するＩＤ記憶手段と、
使用に先立ち通信を許可する他の伝送装置との間で互いにＩＤを照会しあい登録しておくＩＤ照会登録手段とを備えたことを特徴とする伝送装置。

【請求項１１】　請求項１０記載の伝送装置において、
送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の他のすべての伝送装置の周波数時間割を検出し、これら他のすべての伝送装置と常に使用周波数が異なるような周波数時間割を用いて送信を行なう周波数設定手段と、
送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なう再送信手段とを備えたことを特徴とする伝送装置。

【請求項１２】　請求項１０または１１記載の伝送装置において、
受信モードでは通信を許可するＩＤが確認できない時には、音声または映像などの本来の情報を出力させない出力停止手段を備えたことを特徴とする伝送装置。

【請求項１３】　微弱電波を利用して発信局と着信局との間で映像または音声を相互に伝送するための伝送方法であって、
前記微弱電波の到達距離を超えて配置した前記発信局と着信局との間に中継局を配置し、
前記発信局からの送信信号には、映像や音声などの本来の情報に加え、着信局の宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含み、
前記中継局は、前記発信局から受信した微弱電波の周波数とは異なる周波数に変調して出力するとともに、
着信局側から自局が受信する周波数の情報を付加して送信し、
前記着信局は、自局宛の信号であることを認識すると、前記中継局の指定した周波数に微弱電波を変調して映像や音声を送信することにより、発信局と着信局との伝送路を確立することを特徴とする伝送方法。
【請求項１４】　請求項１３記載の伝送方法において、
前記発信局から前記着信局へ向けた往路の送信信号には、標準テレビジョン信号を使用し、
映像信号の垂直帰線消去期間に、ＰＣＭ音声信号と着信局の宛先や自局の指定する受信周波数を示す情報を重畳することを特徴とする伝送方法。
【請求項１５】　標準テレビジョン信号を発生するＲＦコンバータを備えた送信装置と、
標準テレビジョン信号を受信するＲＦチューナを備えた受信装置との間で伝送を行う方法であって、
使用に先立って前記ＲＦチューナの受信帯域内で映像伝送に使用可能な周波数を検出し、
検出した周波数を通信周波数リストとして前記送受信装置双方に登録し、
前記通信周波数リストの範囲内で周波数を切り換えることにより電力スペクトルを拡散して通信を行うことを特徴とする伝送方法。
【請求項１６】　請求項１５記載の伝送方法において、
単位帯域幅当りの電力密度が一定になるように、前記通信の際の送信電力を使用周波数帯域幅に応じて自動的に変化させることを特徴とする伝送方法。
【請求項１７】　請求項１５または１６記載の伝送方法において、
映像信号の同期タイミングに同期して前記通信の際の周波数を切り換えることを特徴とする伝送方法。
【請求項１８】　請求項１５ないし１７のいずれかに記載の伝送方法において、
前記通信の際に、制御信号を帰線消去期間の映像信号上に重畳して伝送することを特徴とする伝送方法。
【請求項１９】　請求項１５ないし１８のいずれかに記載の伝送方法において、
前記通信の際に、音声信号をＰＣＭ化し、帰線消去期間の映像信号上に重畳して伝送することを特徴とする伝送方法。
【請求項２０】　第１および第２の送受信装置はそれぞれ請求項１５ないし１９のいずれかに記載された伝送方法を実行するとともに、
前記通信の際に、前記通信周波数リストの範囲内で周波数の高い方から低い方、もしくは低い方から高い方へ単一方向に周波数切り換えを行なうとともに、周波数が前記周波数リストの最後に達した時は前記周波数リストの最初へ戻すように周波数切り換え順序を制御し、
前記第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間割を用いることにより、複信で通信を行うように制御を行うことを特徴とする伝送方法。
【請求項２１】　請求項２０記載の伝送方法において、
前記通信の開始時には事前に登録してある前記通信周波数リストを使用し、通信開始後は前記通信周波数リストを複製した第２の通信周波数リストを使用するとともに、通信の良否結果情報を前記２組の送受信装置間で交換することにより前記第２の通信周波数リストを随時更新することを特徴とする伝送方法。
【請求項２２】　請求項１５ないし２１のいずれかに記載された伝送方法において、
製造時に伝送装置に付加される識別番号（以下、ＩＤと称す）を記憶し、
使用に先立ち通信を許可する他の伝送装置との間で互いにＩＤを照会しあい登録しておくことを特徴とする伝送方法。
【請求項２３】　請求項２２記載の伝送方法において、
送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の他のすべての伝送装置の周波数時間割を検出し、これら他のすべての伝送装置と常に使用周波数が異なるような周波数時間割を用いて送信を行ない、
送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なうことを特徴とする伝送方法。
【請求項２４】　請求項２２または２３記載の伝送方法において、
受信モードでは通信を許可するＩＤが確認できない時には、音声または映像などの本来の情報を出力させないことを特徴とする伝送方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、微弱レベルの電波を利用して機器間を無線で結び、映像や音声を伝送するための伝送装置および伝送方法に関するものである。特に、本発明の伝送装置および伝送方法は、微弱レベルの電波の到達距離よりも離れて設置された機器間で情報を伝達できるようにしたものに関するものである。
【０００２】また、本発明の伝送装置および伝送方法は、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有

し、マルチパスの影響を軽減でき、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現できるようにしたものに関するものである。また、本発明の伝送装置および伝送方法は、複信での映像伝送を実現でき、マルチパスの影響を解消できるようにしたものに関するものである。さらに本発明の伝送装置および伝送方法は、使用電波エリアが不確定に重なる可能性のある集合住宅等で複数台を同時に使用する場合において、混信を解消でき、傍受を防止することができるようにしたものに関するものである。

【０００３】

【従来の技術】従来、例えば玄関チャイムなどにおいては、映像信号の伝送は、同軸線や平行電線を使用する有線伝送が一般的であった。しかし、取り付け工事の容易さなどから、親機と子機との間を、電波を利用して無線で結ぶ無線映像伝送方式を採用することが検討されている。また、従来、標準テレビジョン放送を受信でき、しかも映像の無線伝送も行なえる方式として、テレビの空きチャンネルの内から１つのチャンネルを選択して微弱電波レベルにより映像を伝送する方法が検討されている。これは、標準テレビジョン信号を発生するＲＦコンバータと標準テレビジョン信号を受信するＲＦチューナを使用するものである。

【０００４】また、これとは別の手段として、放送受信にはＲＦチューナを使用し、映像伝送にはデジタル化した映像信号を、情報圧縮伸張技術を併用し、小電力無線送受信機を使って伝送する方法が検討されている。

【０００５】ここで、上記従来の、微弱電波レベルによる伝送装置の一例としての映像伝送装置を図１１に示す。図１１において、８０１は映像信号を送信する送信機、８０９は送信機８０１に対し映像信号を出力する映像ソース、８０２は標準テレビジョン信号を発生するＲＦコンバータ、８０３はＲＦコンバータ８０２の送信周波数を選択するチャンネルスイッチ、８０４は送信機８０１の送信アンテナである。また、８０５は映像信号を受信する受信機、８０６は受信機８０５の受信アンテナ、８０７は標準テレビジョン信号を受信するＲＦチューナ、８０８はＲＦチューナ８０７により復調された映像信号を再生する映像再生回路、８１０は受信機８０５からの映像を表示する表示部である。

【０００６】次に動作について説明する。上記構成において、送信機８０１側ではＲＦコンバータ８０２によりチャンネルスイッチ８０３で選択された周波数信号を、映像ソース８０９からの映像信号で変調する。そして送信機８０１側ではその変調信号を送信アンテナ８０４を介して送信する。一方、受信機８０５側では受信アンテナ８０６とＲＦチューナ８０７で選択受信した信号から映像再生回路８０８が映像信号を再生し、表示部８１０で映像を表示する。

【０００７】

【発明が解決しようとする課題】このような、電波を利用した無線伝送では、電波は限られた資源であるため、家庭内等の使用範囲が限られた場所では、微弱電波を利用することが適切である。この微弱電波とは、家庭内のテレビジョン受信機などの無線機器に影響を与えない程度のものを言う。しかし、微弱電波は到達距離が短く、このため微弱電波と子機との間隔と子機との距離が制限されてしまうという問題点があった。本発明は、上記のような従来のものの技術的な課題を解決するためになされたもので、微弱電波の到達距離以上に離れて配置した親機や子機などの発信局と着信局との間に伝送路を確立できる伝送装置を得ることを目的としている。

【０００８】また、上記従来の伝送装置では、送信電力が微弱レベルであり、近距離での伝送においても受信感度が小さいことから、マルチパスの影響が大きいという問題点があった。

【０００９】さらに、標準テレビジョン放送の周波数帯域を使用する微弱無線機は、既存のテレビジョン放送の受信に影響を与えるという恐れがある。またそれ以上に、微弱無線機が強力な既存放送波からの影響を受けて使用不可能になるという問題点があった。

【００１０】また、前述した、放送受信にはＲＦチューナを使用し、映像伝送にはデジタル化した映像信号を圧縮伸張技術を併用し、小電力無線送受信機を使って伝送する方法については、ＲＦチューナ・ＡＤコンバータ・ＤＡコンバータ・圧縮伸張処理回路・小電力無線送信機・小電力無線受信機が必要であり、コスト面から実現が困難であるという問題点があった。

【００１１】この発明は、上記のような従来のものの問題点を解決するためになされたもので、標準テレビジョン放送の周波数帯域を使用して情報を送信しても、既存放送波から影響を受けて使用不可能になることがなく、コストの点でも実現が容易な伝送装置および伝送方法を得ることを目的としている。

【００１２】

【課題を解決するための手段】前記課題を解決するために、本発明の請求項１に記載の発明は、微弱電波を利用して映像または音声を伝送する発信局と、微弱電波を利用して映像または音声を伝送する着信局と、前記微弱電波の到達距離を超えて配置した前記発信局と着信局との間に配置した中継局とを備え、前記発信局からの送信信号には、映像や音声などの本来の情報に加え、着信局の宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含み、前記中継局は、前記発信局から受信した微弱電波の周波数とは異なる周波数に変調して出力するとともに、着信局側から自局が受信する周波数の情報を付加して送信し、前記着信局は、自局宛の信号であることを認識すると、前記中継局の指定した周波数に微弱電波を変調して映像や音声を送信することにより、発信局と着信局との伝送路を確立することを特徴とするも

のである。本発明によれば、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送を可能にする。

【0013】また、本発明の請求項2に記載の発明は、請求項1記載の伝送装置において、前記発信局から前記着信局へ向けた往路の送信信号には、標準テレビジョン信号を使用し、映像信号の垂直帰線消去期間に、PCM音声信号と着信局の宛先や自局の指定する受信周波数を示す情報を重畳したことを特徴とするものである。本発明によれば、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送を可能にする。

【0014】また、本発明の請求項3に記載の発明は、標準テレビジョン信号を発生するRFコンバータを備えた送信装置と、標準テレビジョン信号を受信するRFチューナを備えた受信装置と、使用に先立って前記RFチューナの受信帯域内で映像伝送に使用可能な周波数を検出する使用可能周波数検出手段と、検出した周波数を通信周波数リストとして前記送受信装置双方に登録する検出周波数登録手段と、前記通信周波数リストの範囲内で周波数を切り換えることにより電力スペクトルを拡散して通信を行うスペクトル拡散通信手段とを備えたものである。本発明によれば、NTSC方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる。

【0015】また、本発明の請求項4に記載の発明は、請求項3記載の伝送装置において、単位帯域幅当りの電力密度が一定になるように、前記通信の際の送信電力を使用周波数帯域幅に応じて自動的に変化させる送信電力制御手段を備えたものである。本発明によれば、NTSC方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる。

【0016】また、本発明の請求項5に記載の発明は、請求項3または4記載の伝送装置において、映像信号の同期タイミングに同期して前記通信の際の周波数を切り換える周波数切り替え手段を備えたものである。本発明によれば、NTSC方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる。

【0017】また、本発明の請求項6に記載の発明は、請求項3ないし5のいずれかに記載の伝送装置において、前記通信の際に、制御信号を帰線消去期間の映像信号上に重畳して伝送する制御信号重畳伝送手段を備えたものである。本発明によれば、NTSC方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる。

【0018】また、本発明の請求項7に記載の発明は、請求項3ないし6のいずれかに記載の伝送装置において、前記通信の際に、音声信号をPCM化し、帰線消去期間の映像信号上に重畳して伝送する音声信号重畳伝送手段を備えたものである。本発明によれば、NTSC方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる。

【0019】また、本発明の請求項8に記載の発明は、それぞれ請求項3ないし7のいずれかに記載された伝送装置からなる第1および第2の送受信装置と、前記通信の際に、前記通信周波数リストの範囲内で周波数の高い方から低い方、もしくは低い方から高い方へ単一方向に周波数切り換えを行なうとともに、周波数が前記周波数リストの最後に達した時は前記周波数リストの最初へ戻すように周波数切り換え順序を制御する周波数切り替え順序制御手段と、前記第1および第2の送受信装置は常に異なる周波数を使用するような周波数時間網を用いることにより、復信で通信を行うように制御を行う通信制御手段とを備えたものである。本発明によれば、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送装置を提供できる。

【0020】また、本発明の請求項9に記載の発明は、請求項8記載の伝送装置において、前記通信の開始時には事前に登録してある前記通信周波数リストを使用し、通信開始後は前記通信周波数リストを被覆した第2の通信周波数リストを使用するとともに、通信の良否結果情報を前記2組の送受信装置間で交換することにより前記第2の通信周波数リストを随時更新する通信周波数リスト更新手段を備えたものである。本発明によれば、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送装置を提供できる。

【0021】また、本発明の請求項10に記載の発明は、請求項3ないし9のいずれかに記載された伝送装置において、製造時に伝送装置に付加される識別番号（以下、IDと称す）を記憶するID記憶手段と、使用に先立ち通信を許可する他の伝送装置との間で互いにIDを

照会しあい登録しておくＩＤ照会登録手段とを備えたものである。本発明によれば、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送装置を提供できる。

【００２２】また、本発明の請求項１１に記載の発明は、請求項１０記載の伝送装置において、送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の他のすべての伝送装置の周波数時間割を検出し、これら他のすべての伝送装置と常に使用周波数が異なるような周波数時間割を用いて送信を行なう周波数設定手段と、送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なう再送信手段とを備えたものである。本発明によれば、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送装置を提供できる。

【００２３】さらに、本発明の請求項１２に記載の発明は、請求項１０または１１記載の伝送装置において、受信モードでは通信を許可するＩＤが確認できない時には、音声または映像などの本来の情報を出力させない出力停止手段を備えたものである。本発明によれば、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送装置を提供できる。

【００２４】また、本発明の請求項１３に記載の発明は、微弱電波を利用して発信局と着信局との間で映像または音声を相互に伝送するための伝送方法であって、前記微弱電波の到達距離を超えて配置した前記発信局と着信局との間に中継局を配置し、前記発信局からの送信信号には、映像や音声などの本来の情報に加え、着信局の宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含み、前記中継局は、前記発信局から受信した微弱電波の周波数とは異なる周波数に変調して出力するとともに、着信局側から自局が受信する周波数の情報を付加して送信し、前記着信局は、自局宛の信号であることを認識すると、前記中継局の指定した周波数に微弱電波を変調して映像や音声を送信することにより、発信局と着信局との伝送路を確立することを特徴とするものである。本発明によれば、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送を可能にする。

【００２５】また、本発明の請求項１４に記載の発明は、請求項１３記載の伝送方法において、前記発信局から前記着信局へ向けた往路の送信信号には、標準テレビジョン信号を使用し、映像信号の垂直帰線消去期間に、ＰＣＭ音声信号と着信局の宛先や自局の指定する受信周波数を示す情報を重畳することを特徴とするものである。本発明によれば、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送を可能にする。

【００２６】また、本発明の請求項１５に記載の発明は、標準テレビジョン信号を発生するＲＦコンバータを備えた送信装置と、標準テレビジョン信号を受信するＲＦチューナを備えた受信装置との間で伝送を行う方法であって、使用に先立って前記ＲＦチューナの受信帯域内で映像伝送に使用可能な周波数を検出し、検出した周波数を通信周波数リストとして前記送受信装置双方に登録し、前記通信周波数リストの範囲内で周波数を切り換えることにより電力スペクトルを拡散して通信を行うことを特徴とするものである。本発明によれば、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる。

【００２７】また、本発明の請求項１６に記載の発明は、請求項１５記載の伝送方法において、単位帯域幅当りの電力密度が一定になるように、前記通信の際の送信電力を使用周波数帯域幅に応じて自動的に変化させることを特徴とするものである。本発明によれば、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる。

【００２８】また、本発明の請求項１７に記載の発明は、請求項１５または１６記載の伝送方法において、映像信号の同期タイミングに同期して前記通信の際の周波数を切り換えることを特徴とするものである。本発明によれば、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる。

【００２９】また、本発明の請求項１８に記載の発明は、請求項１５ないし１７のいずれかに記載の伝送方法において、前記通信の際に、制御信号を帰線消去期間の映像信号上に重畳して伝送することを特徴とするものである。本発明によれば、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる。

【００３０】また、本発明の請求項１９に記載の発明は、請求項１５ないし１８のいずれかに記載の伝送方法

において、前記通信の際に、音声信号をＰＣＭ化し、帰線消去期間の映像信号上に重畳して伝送することを特徴とするものである。本発明によれば、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる。

【００３１】また、本発明の請求項２０に記載の発明は、第１および第２の送受信装置はそれぞれ請求項１５ないし１９のいずれかに記載された伝送方法を実行するとともに、前記通信の際に、前記通信用波数リストの範囲内で周波数の高い方から低い方、もしくは低い方から高い方へ単一方向に周波数切り換えを行なうとともに、周波数が前記周波数リストの最後に達した時は前記周波数リストの最初へ戻すように周波数切り換え順序を制御し、前記第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間割を用いることにより、複信で通信を行うように制御を行うことを特徴とするものである。本発明によれば、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送方法を提供できる。

【００３２】また、本発明の請求項２１に記載の発明は、請求項２０記載の伝送方法において、前記通信の開始時には事前に登録してある前記通信用波数リストを使用し、通信開始後は前記通信用波数リストを複製した第２の通信用波数リストを使用するとともに、通信の良否結果情報を前記２組の送受信装置間で交換することにより前記第２の通信用波数リストを随時更新することを特徴とするものである。本発明によれば、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送装置を提供できる。

【００３３】また、本発明の請求項２２に記載の発明は、請求項１５ないし２１のいずれかに記載された伝送方法において、製造時に伝送装置に付加される識別番号（以下、ＩＤと称す）を記憶し、使用に先立ち通信を許可する他の伝送装置との間で互いにＩＤを照会しあい登録しておくことを特徴とするものである。本発明によれば、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送方法を提供できる。

【００３４】また、本発明の請求項２３に記載の発明は、請求項２２記載の伝送方法において、送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の他のすべての伝送装置の周波数時間割を検出し、これら他のすべての伝送装置と常に使用周波数が異なるような周波数時間割を用いて送信を行ない、送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なうことを特徴とするものである。本発明によれば、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送方法を提供できる。

【００３５】さらに、本発明の請求項２４に記載の発明は、請求項２２または２３記載の伝送方法において、受信モードでは通信を許可するＩＤが確認できない時には、音声または映像などの本来の情報を出力させないことを特徴とするものである。本発明によれば、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送方法を提供できる。

【００３６】

【発明の実施の形態】（実施の形態１）本実施の形態１は、微弱電波の到達距離以上に離れて配置した親機や子機などの発信局と着信局との間に、映像信号や音声信号の伝送を中継する中継局を配置することにより、微弱電波による伝送路を確立するようにしたものである。この実施の形態１は、本願の請求項１，２および請求項１３，１４に記載された発明に対応するものである。

【００３７】以下に、本発明の実施の形態１について、図面を参照して説明する。ここでは玄関テレビホンを例に挙げて説明している。即ち、この伝送装置は、玄関の子機で撮った来訪者の映像と音声とを室内の親機に伝送し、親機からは音声のみを伝送して、相互の通話を行うものである。

【００３８】図１（ａ）は、本発明の実施の形態１における伝送装置の構成図である。また図１（ｂ）は同伝送装置における各局の回路構成を説明するブロック図である。図１（ａ）において、１は玄関に配置する，子機としての発信局、４は発信局１に接続された端末であり、来訪者の映像を取り込むためのカメラや、室内の居住者との会話のためのマイクやスピーカを有する。２は中継局であり、廊下などに配置するため、映像や音声を入出力するための端末は備えていない。３は室内に配置する，親機としての着信局、５は着信局３に接続された端末であり、来訪者を映すモニタや、来訪者と室内の居住者との会話のためのマイクやスピーカなどを有するものである。

【００３９】また、６は発信局１の微弱電波の到達範囲を示しており、この圏内に中継局２を配置している。７は中継局２の出力する微弱電波の到達範囲を示しており、この圏内に発信局１と着信局３を配置している。８は着信局の出力する微弱電波の到達範囲を示しており、この圏内に中継局２を配置している。

【００４０】次に動作について説明する，各局１，２，３は互いに異なる周波数で送受信を行う。すなわち発信局１は、端末４から着信局３を呼び出す信号を周波数ｆ１にて送信する。このとき発信局１は、自局の受信する

周波数がｆ０である旨を指定する。中継局２は受信した呼び出しの信号をこれとは異なる周波数ｆ２に変調して出力する。このとき中継局２は、自局の受信する周波数がｆ１である旨の情報を付加して出力する。さらに、着信局３は、周波数ｆ２の呼び出し信号を受信して端末５に出力する。そして、着信局３は、端末５からの応答の信号を、中継局２が指定する周波数ｆ１にて出力する。中継局２は、自局の指定する受信周波数の応答信号を受信すると、これを発信局１の指定する周波数に変調して出力し、これを発信局１が受信することで、伝送路が確立される。

【００４１】図３に子機としての発信局１側から親機としての着信局３へと送信される変調信号の一例を示す。これは、標準テレビジョンで使用する映像信号の奇数フィールドの垂直帰線消去期間３０１における水平走査期間３０２に、ＰＣＭ音声信号３０３と、システム制御信号３０４を重畳したものである。ＰＣＭ音声信号３０３には、発信局１の端末４からの音声情報を含んでいる。システム制御信号３０４には、端末５を備えた局３が着信先であることを示す宛先情報や、自局が受信する周波数の情報などを含んでいる。

【００４２】図１（ｂ）は各局の回路のブロック図を示している。各局の本体１１０１は、他局から受信した映像またはは音声信号を復調するとともに、自局の受信する周波数を指定するための選局兼映像音声復調回路１１０２と、音声信号とシステム制御信号とが重畳した映像信号を変調する高周波映像変調回路１１０３と、音声信号を変調する高周波音声変調回路１１０４と、これら各回路の周波数の切り換えを制御したり、各局の本体１１０１とこれに接続された端末１１０７との間で映像信号、音声信号、操作信号のやり取り等を行うための制御回路１１０５と、送受信アンテナ１１０６とを備えている。１１０７は各局本体１１０１に向けて映像信号や音声信号、機器の操作のための操作信号を発信したり、逆に各局本体１１０１からの映像信号や音声信号、操作信号を受信したりする端末である。上述のように中継局２には設置していない。

【００４３】以下、図２を用いて、伝送路が順次延びて確立していく様子を具体的に説明する。まず、発信局１が電波の発射を行っていない段階では、各局は、選局兼映像音声復調回路１１０２を動作させている。そして予め決められた周波数範囲内を、他局からの電波が発射されていないかをスキャンしながらモニターしている。そして発信局１は同時に、これに接続された端末４からの送信リクエストがないかを監視している。

【００４４】そして図２（ａ）に示す第１段階として、発信局１に端末４からの映像・音声信号と送信リクエストが入力されると、発信局１は、図３に示す変調信号で変調された周波数ｆ１の高周波信号を送信する。この信号には上述したように、着信局３を示す情報と、自局の受信局周波数がｆ０である情報とを付加（重畳）している。このｆ１、ｆ０の周波数は、送信リクエストを受け取るまで周波数モニターを行っていた結果に基づき、他の無線機器が使用しておらず、かつノイズの少ない周波数を予め選択しておく。

【００４５】端末４からの音声情報をＰＣＭ音声信号として映像信号に重畳して送信する理由は、通常では標準テレビジョンで使用する音声伝送のための周波数を、中継局２の復路伝送として使用するためである。このため、往路においては、この音声伝送のための周波数は無変調のまま送信する。一方、他局から電波が発射されているか否かをモニターしていた中継局２は、発信局１の電波到達距離内にいることから、この発信局１からの周波数ｆ１の送信電波を受信する。このとき着信局３は発信局１からの電波到達距離にいないことから受信はできない。

【００４６】次に図２（ｂ）に示す第２段階として、中継局２は、受信電波を復調した結果、着信宛先が自局でないことを知る。そこで復調した映像信号上のシステム制御信号に、自局が受信する周波数がｆ１であるという情報を付加して変調信号とし、ｆ２の周波数で変調して送信する。この送信周波数ｆ２は事前に周波数をモニターしていた結果をもとに選択するものである。

【００４７】加えて、中継局２では、発信局１がｆ０の周波数で受信をしており、このｆ０の周波数を復路で使用しなければならないことを知る。そこで中継局２は、受信して得られる音声復調信号を、そのままｆ０の周波数に変調して送信し、復路を確立する。一方、他局から電波が発射されているか否かをモニターしていた着信局３は、中継局２からの電波の到達距離内にいることから、中継局２からのｆ２の送信電波を受信する。

【００４８】図２（ｃ）に示す第３段階として、着信局３では、受信電波を復調した結果、宛先が自局につながる端末５であることを知る。そこで受信した映像信号上のＰＣＭ音声信号から音声を復調するとともに、システム制御信号から端末５の操作信号を抽出して、映像信号と分離し、これら、操作信号，映像信号，音声信号を端末５へ出力する。

【００４９】また、着信局３では、中継局２がｆ１の周波数で受信状態となっており、ｆ１の周波数を復路として使用しなければならないことを知る。そこで映像信号が正常に行われたという応答信号を可聴範囲外音で変調し、この可聴範囲外音信号に端末５からの音声信号を重畳したものを変調信号として、ｆ１の周波数に変調し送信する。

【００５０】周波数ｆ１の電波を受信した中継局２は、ｆ０の周波数で既に復路を確立しているので、着信局３からの応答信号と音声信号は、ｆ０の周波数で発信局１へと即座に送信することができる。そして発信局１は、この中継局２からの受信電波のなかから応答信号と音声

信号を分離することにより、応答信号からは映像伝送が正常に動作中であることをモニターし続けることができるとともに、端末５からの音声を受け取ることができるので、音声の双方向伝送が可能となる。

【００５１】このように、本実施の形態１によれば、発信局から送信する信号には、映像や音声の他に、どの着信局向けなのか宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含め、中継局は、発信局側からの信号を、受信した周波数とは異なる周波数に変調して出力し、このとき中継局は、着信局側から自局が受信する周波数を示す情報を付加して送信し、着信局は、自局宛の信号であることを認識すると、映像または音声信号を中継局の指定した周波数に変調して送信する。この信号を中継局は順次発信局側へと伝送することで、子機側の発信局１と親機側の着信局３との距離が微弱電波の到達距離を超える距離であっても、発信局と着信局との伝送路を確立することができる。そして映像については半二重、音声については全二重の伝送が可能になり、かつシステムの制御信号の伝送が可能になる。

【００５２】なお本実施の形態１では、中継局を１つだけで構成したが、中継局を増やして微弱電波の到達範囲ごとに順に配置して行けば、発信局と着信局との距離をより一層長くすることができる。また、映像信号については、子機側から親機側への一方向の伝送例を示したが、高周波映像変調回路の使用周波数と、高周波音声変調回路の使用周波数を入れ替えれば往路、復路が反転することから、使用周波数の入れ替えを高速に行うことにより、見かけ上、映像の双方向同時伝送を行うことが可能となる。

【００５３】さらに、上記実施の形態１では、中継局には端末を設けない例を示したが、中継局を増やすと同時に中継局にも端末を付加すれば、発信局、着信局は固定されず、任意の局どうしで伝送路を確立することができる。また、本実施の形態１では、端末を玄関テレドホンを例に挙げて説明したが、これに限らず、端末としてビデオカメラやＶＴＲ、携帯型のテレビ電話などにも応用することが可能となる。また、本実施の形態１ではデジタル化された音声信号をＰＣＭ化するようにした場合を示したが、他の圧縮符号化方式を用いることも可能である。

【００５４】（実施の形態２）本実施の形態２は、周波数拡散通信を行うことにより、微弱電波を用いてもマルチパスの影響を受けることなく情報の伝送を行えるものである。以下、本発明の実施の形態２について、図４、図６、図７、図８、図９および表１を用いて説明する。この実施の形態２は、本願の請求項３ないし請求項７および請求項１５ないし請求項１９に記載された発明に対応するものである。

【００５５】図４は本発明の実施の形態２による伝送装置の構成を示している。また、図６は本発明の実施の形態２の信号電力を示している。また、図７は本発明の実施の形態２の受信レベルを示している。また、図８は本発明の実施の形態２の映像の伝送状態を、従来例との比較で示している。また、図９は本発明の実施の形態２の映像信号を示している。また、表１は本発明の実施の形態２の周波数切り替え順序を示している。

【００５６】

【表１】

時間	送信→受信
	f_1
	f_2
	f_3
	f_4
	f_5
	⋮
	f_n
	f_1
	f_2
	⋮

図４において、１０１は送信を行う送信装置、１１５は電波を送信する送信アンテナ、１０２は標準テレビジョン信号を発生するＲＦコンバータ、１１１は制御電圧に応じた周波数で発振する電圧制御発振器、１１２は２つの入力信号を加算することで合成を行う合成器、１１３は２つの入力を乗算することで合成を行うミキサ、１１４は制御信号に応じて入力を減衰する可変アッテネータ、１０３は外部からの入力を受ける通信端子、１０４は外部機器を接続するための外部機器接続端子、１０５は音声信号を入力するための音声入力端子、１０６は映像信号を入力するための映像入力端子、１０９はアナログ信号をデジタル信号に変換するＡＤコンバータ、１１０は入力信号を設定値と比較するコンパレータ、１０７はこの送信装置１０１の制御を行う制御回路、１０８は制御回路１０７が情報を記憶するのに用いる記憶回路、１１６はこの送信装置１０１の設定を登録するための登録ボタンである。

【００５７】また、１１７は受信を行う受信装置、１３２は電波を受信する受信アンテナ、１１８は標準テレビジョン信号を受信するＲＦチューナ、１２８は制御電圧に応じた周波数で発振する電圧制御発振器、１２９は２つの入力を乗算することで合成を行うミキサ、１３０は信号の利得を自動調整するＡＧＣ回路、１３１は中間周波数信号を処理する中間周波数処理回路、１２３はこの受信装置１１７を制御する制御回路、１２４は制御回路１２３が情報を記憶するのに用いる記憶回路、１２５はデジタル信号をアナログ信号に変換するＤＡコンバータ、１２６は入力信号を設定値と比較するコンパレータ、１２７は２系統の音声信号のいずれか一方を出力する音声切替えスイッチ、１３３はこの受信装置１１７に対する送信の有無の検出を指示するための検出ボタン、

１１９は外部に信号を出力するための通信端子、１２０は外部機器を接続するための外部機器接続端子、１２１は映像信号を出力するための映像出力端子、１２２は音声信号を出力するための音声出力端子である。

【００５８】また、５００は請求項３に記載された使用可能周波数検出手段である。この使用可能周波数検出手段５００は使用に先立ってＲＦチューナの受信帯域内で映像伝送に使用可能な周波数を検出するものであり、ＲＦチューナ１１８と制御回路１２３と記憶回路１２４とコンパレータ１２６と検出ボタン１３３とで構成される。

【００５９】また、５０１は請求項３に記載された周波数登録手段である。この周波数登録手段５０１は、検出、検出した周波数を通信周波数リストとして送受信装置双方に登録するものであり、通信端子１０３，１１９と制御回路１０７，１２３と記憶回路１０８，１２４と登録ボタン１１６とで構成される。

【００６０】また、５０２は請求項３に記載されたスペクトル拡散通信手段である。このスペクトル拡散通信手段５０２は、通信周波数リストの範囲内で周波数を高速に切り換えることにより電力スペクトルを拡散して通信するものであり、制御回路１０７，１２３と記憶回路１０８，１２４とＲＦコンバータ１０２とＲＦチューナ１１８とで構成される。

【００６１】また、５０３は請求項４に記載された送信電力制御手段である。この送信電力制御手段５０３は単位帯域幅当りの電力密度が一定になるように送信電力を使用周波数帯域幅に応じて自動的に変化させるものであり、制御回路１０７と記憶回路１０８と可変アッテネータ１１４とで構成される。

【００６２】また、５０４は請求項５に記載された周波数切り替え手段である。この周波数切り替え手段５０４は映像信号の同期タイミングで周波数を切り換えるものであり、映像入力端子１０６とコンパレータ１１０，１２６と制御回路１０７，１２３とで構成される。

【００６３】また、５０５は請求項６に記載された制御信号重畳伝送手段である。この制御信号重畳伝送手段５０５は制御信号を帰線消去期間の映像信号上に重畳して伝送するものであり、外部機器接続端子１０４，１２０と制御回路１０７，１２３とコンパレータ１１０，１２６と合成器１１２とで構成される。

【００６４】また、５０６は請求項７に記載された音声信号重畳伝送手段である。この音声信号重畳伝送手段５０６は、音声信号をＰＣＭ化し帰線消去期間の映像信号上に重畳して伝送するものであり、音声入力端子１０５と音声出力端子１２２とＡＤコンバータ１０９とＤＡコンバータ１２５と制御回路１０７，１２３とコンパレータ１１０，１２６と合成器１１２と音声切換スイッチ１２７とで構成される。

【００６５】ここで、映像伝送に使用可能な周波数とは、図６において、符号３０７で示された周波数帯域のことである。この映像伝送に使用可能な周波数３０７には、放送波３０５が無く、さらに外来ノイズや強い放送波のイメージ受信３０６も無い。

【００６６】次に動作について説明する。図４において、操作者により受信装置１１７の検出ボタン１３３が押されると、制御回路１２３が動作を開始する。制御回路１２３は、受信帯域３０３内のすべての周波数を一通り受信するように、ＲＦチューナ１１８を制御する。ＲＦチューナ１１８の映像出力はコンパレータ１２６に入力され。所定の検出値と比較される。その比較結果は制御回路１２３に入力される。制御回路１２３はその比較結果に基づき、放送波および放送波のイメージ波による映像同期信号や、外来ノイズによるランダム信号の無い周波数を映像伝送に使用可能な周波数を検出し、記憶回路１２４にリストとして記憶する。

【００６７】また、使用に先だって、送信装置１０１と受信装置１１７間がいったん通信端子１０３，１１９を介してケーブルで接続された後、操作者により送信装置１０１の登録ボタン１１６が押されると、送信装置１０１の制御回路１０７は通信端子１０３を介して受信装置１１７の制御回路１２３に対し、映像伝送に使用可能な周波数のリストを要求する。

【００６８】受信装置１１７の制御回路１２３は記憶回路１２４に記憶されていた映像伝送に使用可能な周波数のリストを読み出し、通信周波数リストとして再びその記憶回路１２４に記憶するとともに、通信端子１１９，１０３を介して送信装置１０１にも送出する。送信装置１０１では受信装置１１７から送られてきた映像伝送に使用可能な周波数のリストを通信周波数リストとして記憶回路１０８に記憶する。

【００６９】図４において、送信装置１０１の外部機器制御端子１０４に外部機器からの映像伝送リクエスト信号が入力され、さらに映像入力端子１０６に外部機器からの映像信号が入力されると、送信装置１０１の制御回路１０７は記憶回路１０８に記憶されている通信周波数リストを読み出す。そしてこれと並行して可変アッテネータ１１４の減衰量を最大に設定した後、ＲＦコンバータ１０２を動作させる。

【００７０】さらに、制御回路１０７は、読み出した通信周波数リストの範囲内を、例えば表１に示す周波数切り替え順序により、ＲＦコンバータ１０２のＲＦ周波数を高速に切り換えることで電力スペクトルを拡散した後、可変アッテネータ１１４の減衰量を小さくして送信を開始する。なお、表１の周波数の切り換え順序は、送信装置１０１と受信装置１１７で予め取り決めているものの一例を示したものである。

【００７１】また、通信周波数は映像入力端子１０６から入力される映像信号の水平同期信号もしくは垂直同期信号のタイミングに合わせて切り換えられる。その際、

使用する同期信号はコンパレータ１１０により映像信号から抽出される。

【００７２】ここで、他の無線機器への影響を防止し電波の有効利用を図るには、送信装置１０１から送信される単位帯域幅当りのＲＦ電力密度を図６に示す微弱電波レベル３０４以下にする必要がある。よって制御回路１０７は通信周波数リストから使用周波数の帯域幅および電力スペクトルの拡散率を求め、これにより単位帯域幅当りのＲＦ電力密度を一定にするように可変アッテネータ１１４の減衰量を調整する。

【００７３】一方、図４において、受信装置１１７の外部機器制御端子１２０に、外部機器から映像受信のリクエスト信号が入力されると、受信装置１１７の制御回路１２３は記憶回路１２４に記憶されている通信周波数リストを読み出すとともに、ＲＦチューナ１１８を動作させる。

【００７４】これにより、制御回路１２３はＲＦチューナ１１８の受信周波数を高速に切り換えて、送信装置１０１からのＲＦ信号を受信する。その切り替えは、制御回路１２３が読み出した通信周波数リストの範囲内を、表１に示す周波数の切り替え順序となるようにこれを行う。また周波数の切り換えタイミングは、制御回路１２３内部で発生する疑似同期タイミングを使用して切り替えを行う。

【００７５】ここで、受信装置１１７で受信を開始してすぐの期間には、送信側の映像信号の同期タイミングと受信側の疑似同期タイミングは必ずしも一致していない。さらに送信用周波数と受信用周波数も時間的に必ずしも一致していないことから、受信装置１１７のＲＦチューナ１１８の映像出力およびコンパレータ１２６の出力には信号は現れていない。よって、受信装置１１７の制御回路１２３は、コンパレータ１２６の出力をモニタしながら、疑似同期タイミングと受信周波数の時間割スタート時刻を順次変化させて、送信信号の検出を試みる。ここで、送信側の映像信号の同期タイミングと送信用周波数の時間割同期は一定であることから、受信側では一定の試行の後、送信信号の検出に成功する。送信信号の検出に成功すると、受信装置１１７の制御回路１２３はコンパレータ１２６により抽出された受信映像信号の同期タイミングを、疑似同期タイミングに換えて使用する。

【００７６】一般に、広い帯域を使用する無線伝送の受信レベルは、マルチパスや送受信アンテナの周波数特性の影響を受ける。マルチパスや送受信アンテナの周波数特性の影響を受けた場合、図７に示す特性４０６のように、受信レベルが大きく変化する。そして、受信レベルが通信限界レベル４０７以下となる周波数では、映像信号は再生できない。よって単一周波数を使用する従来の方式においては、使用中に送、受信装置の位置が変化した場合や、電波を反射する周囲反射物の位置が変化した場合には、図８（ａ）に示すように全く電波を受信できなくなる症状が発生し、使用感が著しく低下していた。これに対し、本発明の実施の形態２では、図８（ｂ）に示すように、映像信号の一部が再生できなくなるだけなので、受信状態が改善される。

【００７７】ここで、一般に、他の無線機器への影響を防止し電波の有効利用を図るために、微弱電波を使用する無線送信装置は、一定距離だけ離れた地点での電界強度の上限が制限されている。その上限は既存の同じ周波数帯を使用する他の無線機器に対する影響の度合いで決定されるが、その検査測定方法は影響を受ける可能性がある側の無線機器の方式を基準に決定される。なお、一定距離だけ離れた地点での電界強度の制御は、機器に固定の送信アンテナを使用する場合では送信電力を制御することで実現できる。

【００７８】また、単一周波数を使用する方式の無線機器同士、およびスペクトルを拡散して使用する方式の無線機器同士の相互影響は大きいが、両方式間での相互影響は小さいという方式がある。標準テレビジョン放送の周波数帯を使用スペクトルを拡散して送信する本発明の伝送装置と、既存の他の無線機器、即ち、単一周波数を使用するテレビ受像機、についてもこの状況があてはまる。

【００７９】以上の理由から、標準テレビジョン放送の周波数帯を使用し、スペクトルを拡散して送信する本実施の形態の伝送装置では、従来の単一周波数を使用する方式に比べてより大きな出力電力での送信が可能である。これに伴って、受信電力も増大するので伝送距離も長くすることができる。

【００８０】さらに、本実施の形態の伝送装置では、使用に先立って映像伝送に使用可能な周波数を検出登録して使用している。このため、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても、これらのシステムとの共存が可能である。

【００８１】ここで、送信装置１０１から映像信号が送信されている状態において、受信装置１１７に接続された外部機器を操作する制御信号が送信装置１０１の外部機器接続端子１０４に入力されると、送信装置１０１の制御回路１０７は、図９に示す帰線消去期間の映像信号上に重畳するタイミングで、受け取った制御信号をＲＦコンバータ１０２に出力する。制御信号はＲＦコンバータ１０２内の合成器１１２にて、図９のデータ６０５の部分に重畳され、受信装置１１７に向けて送信される。

【００８２】制御信号が重畳された映像信号を受信した受信装置１１７では、映像信号からコンパレータ１２６にて制御信号を抽出して外部機器接続端子１２０へ出力する。これにより、送信装置１０１に接続された外部機器から受信装置１１７に接続された外部機器を操作することが可能となり、高機能な映像伝送装置が実現される。

【００８３】また、送信装置１０１から映像信号が送信

されている状態において、音声信号が音声入力端子１０５に入力されると、送信装置１０１のADコンバータ１０９にてAD変換された音声信号が制御回路１０７に入力される。AD変換された音声信号が入力されると、制御回路１０７は受け取った音声信号をさらにPCM化し、図９に示す帰線消去期間の映像信号上に重畳するタイミングで、このPCM信号をRFコンバータ１０２に出力する。PCM信号はRFコンバータ１０２内の合成器１１２にて、図９のデータ６０５の部分に重畳され、受信装置１１７に向けて送信される。

【００８４】PCM信号が重畳された映像信号を受信した受信装置１１７では、映像信号からコンバレータ１２６にてPCM信号を抽出して制御回路１２３へ出力する。制御回路１２３はPCM信号をDAコンバータ１２５へ出力するとともに、音声スイッチ回路１２７をPCM音声使用状態に切り換える。DAコンバータ１２５ではPCM信号を音声信号に変換して音声出力端子１２２へ出力する。これにより、通信周波数の切り替えに伴なう音声ノイズの無い高品位な音声伝送が実現される。

【００８５】このように、本実施の形態２による伝送装置は、使用に先立って受信装置内のRFチューナの受信帯域内で映像伝送に使用可能な周波数を検出し、検出した周波数を通信周波数リストとして前記送信装置および受信装置の双方に登録し、前記通信周波数リストの範囲内で周波数を高速に切り換えることにより電力スペクトルを拡散して通信するようにしたので、テレビジョン放送の受信機能も有する安価な単向、即ち、一方向への映像伝送を実現することができる。また、マルチパスの影響を低減でき、強力な既存放送波にも影響されない。しかも、単一の周波数を使用する方式よりも長い通信距離を達成でき、将来のデジタルテレビジョン放送や、移動体通信が同帯域を使用しても共存可能な映像伝送装置を実現することができる。

【００８６】また、単位帯域幅当りの電力密度が一定になるように、送信電力を使用周波数帯域幅に応じて自動的に変化させるようにしており、使用周波数帯域幅が変化しても常に既存の無線受信装置に受信妨害を与えることのない微弱な電波レベルで動作する映像伝送装置を実現することができる。また、映像信号の同期タイミングで周波数を切り換えるようにしており、周波数の切り換えに伴なう映像信号の乱れを低減でき、良好な画質の映像伝送装置を実現することができる。

【００８７】また、制御信号を帰線消去期間の映像信号上に重畳して伝送するようにしたので、送信装置から受信装置の動作を制御可能な高機能な映像伝送装置を実現することができる。また、音声信号をPCM化し、帰線消去期間の映像信号上に重畳して伝送するようにしたので、周波数の切り換えに伴なう音声信号の雑音を無くし、良好な音質の映像伝送装置を実現することができる。

【００８８】従って、NTSC方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現できる。また、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存が可能であり、カメラが記録部本体からワイヤレスで取り外し可能なVTRムービー装置等に応用することが可能である。

【００８９】また、本実施の形態２ではデジタル化された音声信号をPCM化するようにした場合を示したが、他の圧縮符号化方式を用いることも可能である。さらに、本実施の形態２では標準テレビジョン信号としてNTSC方式を用いるようにした場合を示したが、PAL方式やSECAM方式を用いることも可能である。

【００９０】（実施の形態３）この実施の形態３は、実施の形態２の送信装置および受信装置を併せ持つ送受信装置を、２つ設けるようにしたものである。以下、本発明の実施の形態３について、図５、図６、図７、図８、図９および表２を用いて説明する。この実施の形態３は、本願の請求項８，９および請求項２０，２１に記載された発明に対応している。

【００９１】図５は本発明の実施の形態３による伝送装置の構成を示している。また、図６は本発明の実施の形態３における信号電力を示している。また、図７は本発明の実施の形態３の受信レベルを示している。また、図８は本発明の実施の形態３の映像の伝送状態を、従来例との比較で示している。また、図９は本発明の実施の形態３の映像信号を示している。また表２は本発明の実施の形態３の周波数切り替え順序、および周波数時間割を示している。

【００９２】

【表２】

時制	第1→第2	第2→第1
	f_1	f_{n-1}
	f_2	f_n
	f_3	f_1
	f_4	f_2
	f_5	f_3
	⋮	⋮
	f_n	f_{n-2}
	f_1	f_{n-1}
	f_2	f_n
	⋮	⋮

図において、２０１Ａおよび２０１Ｂは送受信を行う送受信装置、２０２Ａ，２０２Ｂは標準テレビジョン信号を発生するRFコンバータ、２１５Ａ，２１５Ｂは制御電圧に応じた周波数で発振する電圧制御発振器、２１６Ａ，２１６Ｂは２つの入力信号を加算することで合成する合成器、２１７Ａ，２１７Ｂは２つの入力信号を乗算することで合成するミキサ、２１８Ａ，２１８Ｂは制御

信号に応じて入力信号を合成する可変アッテネータ、２１９Ａ，２１９Ｂは電波を送受信する送受信アンテナ、２０７Ａ，２０７Ｂは外部からの入力を受け外部に信号を出力するための通信端子、２０８Ａ，２０８Ｂは外部機器を接続するための外部機器接続端子、２０５Ａ，２０５Ｂは音声信号を入力するための音声入力端子、２０４Ａ，２０４Ｂは映像信号を入力するための映像入力端子、２１３Ａ，２１３Ｂはアナログ信号をデジタル信号に変換するＡＤコンバータ、２１４Ａ，２１４Ｂは入力信号を設定値と比較するコンパレータ、２１１Ａ，２１１Ｂはこの送受信装置２０１Ａ，２０１Ｂを制御する制御回路、２１２Ａ，２１２Ｂは制御回路２１１Ａ，２１１Ｂが情報を記憶するのに用いる記憶回路、２０６Ａ，２０６Ｂはこの送受信装置２０１Ａ，２０１Ｂの設定を登録したり、この送受信装置２０１Ａ，２０１Ｂに対する送信の有無の検出を指示するための検出登録ボタン、２０３Ａ，２０３Ｂは標準テレビジョン信号を受信するＲＦチューナ、２２０Ａ，２２０Ｂは制御電圧に応じた周波数で発振する電圧制御発振器、２２１Ａ，２２１Ｂは２つの入力を乗算することで合成するミキサ、２２２Ａ，２２２Ｂは信号の利得を調整するＡＧＣ回路、２２３Ａ，２２３Ｂは中間周波数信号を処理する中間周波数処理回路、２２４Ａ，２２４Ｂはデジタル信号をアナログ信号に変換するＤＡコンバータ、２２５Ａ，２２５Ｂは入力信号を設定値と比較するコンパレータ、２２６Ａ，２２６Ｂは２系統の音声信号のいずれか一方を出力する音声切替えスイッチ、２０９Ａ，２０９Ｂは映像信号を出力するための映像出力端子、２１０Ａ，２１０Ｂは音声信号を出力するための音声出力端子である。ここで、２０１Ａおよび２０１Ｂはそれぞれ請求項８に記載された、第１の送受信装置および第２の送受信装置である。

【００９３】また、５１０は請求項８に記載された周波数切り換え順序例御手段である。この周波数切り換え順序制御手段５１０は、周波数切り換え順序を通信周波数リストの範囲内で高い方から低い方、もしくは低い方から高い方へ単一方向に行なうとともに、周波数リストの最後に達した時は周波数リストの最初へ戻すように周波数切り換え順序を制御するものであり、制御回路２１１Ａと記憶回路２１２Ａとで構成される。

【００９４】また、５１１は請求項８に記載された通信制御手段である。この通信制御手段５１１は、第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間割を用いることにより、擬信、即ち双方向で通信を行うように制御を行うものであり、制御回路２１１Ａと記憶回路２１２Ａとで構成される。

【００９５】また、５１２は請求項９に記載された通信周波数リスト更新手段である。この、通信周波数リスト更新手段５１２は通信開始時には登録してある通信周波数リストを使用し、通信開始後は通信周波数リストを複製した第２の通信周波数リストを使用するとともに、第２の通信周波数リストは通信の良否結果情報を２組の送受信装置間で交換するものであり、制御回路２１１Ａと記憶回路２１２Ａとコンパレータ２１４Ａ，２２５Ａと合成器２１６Ａとで構成される。そして、第１および第２の送受信装置２０１Ａと２０１Ｂにはそれぞれ、図５に示した送信装置および受信装置を構成する装置や手段が一組ずつ備えられている。

【００９６】次に動作について説明する。図５において、操作者が第１の送受信装置２０１Ａの検出登録ボタン２０６Ａを押すと、制御回路２１１Ａが動作を開始する。これにより、図３に示す受信帯域３０３内のすべての周波数を一通り受信するように、制御回路２１１ＡはＲＦチューナ２０３Ａを制御する。

【００９７】ＲＦチューナ２０３Ａの映像出力はコンパレータ２２５Ａに入力される。その判定結果が制御回路２１１Ａに入力され、制御回路２１１Ａは放送波および放送波のイメージ波による映像同期信号や、外来ノイズによるランダム信号の無い周波数を映像伝送に使用可能な周波数として検出する。そしてこれらを記憶回路２１２Ａにリストとして記憶する。

【００９８】また、第２の送受信装置２０１Ｂも第１の送受信装置２０１Ａと全く同様に構成されており、上述した第１の送受信装置２０１Ａと同様に検出登録ボタン２０６Ｂが押された後、一連の動作を行なう。

【００９９】ここで、第１および第２の送受信装置は必ずしも同じ位置や同じ向きで使用されるとは限らない。このため、通常、アンテナ２１９Ａおよび２１９Ｂの向きは放送波の到来方向とは異なっており、映像伝送に使用可能な周波数として検出記憶するリストは食い違っていると考えられる。

【０１００】次に、第１の送受信装置２０１Ａと第２の送受信装置２０１Ｂが通信端子２０７Ａ，２０７Ｂを介して有線で接続された後、検出登録ボタン２０６Ａ，２０６Ｂのどちらか一方が押されると、一方の送受信装置の制御回路は通信端子を介して他方の送受信装置の制御回路に映像伝送に使用可能な周波数のリストを要求する。以下、第１の送受信装置２０１Ａの検出登録ボタン２０６Ａが押されたものとして説明を行う。

【０１０１】第２の送受信装置２０１Ｂの制御回路２１１Ｂは記憶回路２１２Ｂに記憶されていた映像伝送に使用可能な周波数のリストを読み出す。そしてこのリストを、通信端子２０７Ｂを介して第１の送受信装置２０１Ａに送出する。

【０１０２】第１の送受信装置２０１Ａでは、記憶回路２１２Ａに記憶されていた映像伝送に使用可能な周波数リストを読み出し、第２の送受信装置２０１Ｂから送られてきた映像伝送に使用可能な周波数のリストとの積を取り、その結果を通信用波数リストとして記憶回路２１２Ａに記憶するとともに、通信端子２０７Ａにも送出す

る。第２の送受信装置２０１Ｂでは、第１の送受信装置２０１Ａから送られてきた通信周波数リストを記憶回路２１２Ｂに記憶する。

【０１０３】次に、図５において、第１の送受信装置２０１Ａの外部機器制御端子２０８Ａには外部機器からの映像伝送リクエスト信号が、さらに映像入力端子２０４Ａには外部機器からの映像信号が入力されるものとする。このとき、制御回路２１１Ａは記憶回路２１２Ａに記憶されている通信周波数リストを読み出す。これとともに可変アッテネータ２１８Ａの減衰を最大に設定した後、ＲＦコンバータ２０２Ａを動作させる。

【０１０４】さらに、制御回路２１１Ａは、読み出した通信周波数リストの範囲内を、例えば表２の第１列、即ち左端の列に示すような高い方から低い方、もしくは低い方から高い方へ単一方向に変化し、さらに、通信周波数リストの最後に達した時はリストの最後に戻るように変化する周波数切り替え順序により、ＲＦコンバータ２０２ＡのＲＦ周波数を高速に切り換える。このような周波数の切り替えを行うことで、電力スペクトルを拡散した後、可変アッテネータ２１８Ａの減衰量を小さくして送信を開始する。なお、表２に示した周波数の切り換え順序は、第１の送受信装置２０１Ａと第２の送受信装置２０１Ｂで予め取り決めているものが使用される。

【０１０５】また、通信周波数は映像入力端子２０４Ａから入力される映像信号の水平同期信号もしくは垂直同期信号のタイミングに合わせて切り換えられる。また、使用する同期信号はコンバレータ２１４Ａにより映像信号から抽出される。

【０１０６】ここで、他の無線機器への影響を防止し電波の有効利用を図るには、送信される単位帯域幅当りのＲＦ電力密度を図６に示す散弱レベル３０４以下にする必要がある。よって制御回路２１１Ａは通信周波数リストから使用周波数の帯域幅および電力スペクトルの拡散率を求め、これにより、単位帯域幅当りのＲＦ電力密度を一定にするように可変アッテネータ２１８Ａの減衰量を調整する。

【０１０７】一方、図５において、第２の送受信装置２０１Ｂの外部機器制御端子２０８Ｂに、外部機器から映像受信のリクエスト信号が入力されると、第２の送受信装置の制御回路２０８Ｂは記憶回路２１２Ｂに記憶されている通信周波数リストを読み出すとともに、ＲＦチューナ２０３Ｂを動作させる。

【０１０８】さらに第２の送受信装置２０１Ｂの制御回路２１１Ｂは読み出した通信周波数リストの範囲内を、表２の第１列に示す周波数の切り替え順序により、また周波数の切り換えタイミングは制御回路２１１Ｂ内部で発生する疑似同期タイミングを使用し、ＲＦチューナ２０３Ｂの受信周波数を高速に切り換えて第１の送受信装置２０１Ａからの信号を受信する。

【０１０９】ここで第２の送受信装置２０１Ｂで受信を開始してすぐの期間には、送信側の映像信号の同期タイミングと受信側の疑似同期タイミングは必ずしも一致していない。また、送信周波数と受信周波数も必ずしも時間的に一致していないことから、第２の送受信装置のＲＦチューナ２０３Ｂの映像出力およびコンパレータ２２５Ｂの出力には信号は現れていない。

【０１１０】よって第２の送受信装置２０１Ｂの制御回路２１１Ｂは、コンパレータ２２５Ｂの出力をモニタしながら、疑似同期タイミングと受信周波数の時間割スタート時刻を順次変化させることで第１の送受信装置の送信信号の検出を試みる。

【０１１１】ここで、第１の送受信装置２０１Ａの映像信号の同期タイミングと送信周波数の時間割周期は一定であることから、第２の送受信装置２０１Ｂでは一定の試行の後、第１の送受信装置２０１Ａの送信信号の検出に成功する。

【０１１２】第１の送受信装置２０１Ａの送信信号の検出に成功すると、第２の送受信装置２０１Ｂの制御回路２１１Ｂはコンパレータ２２５Ｂにより抽出された受信映像信号の同期タイミングを、疑似同期タイミングに換えて使用する。

【０１１３】また第２の送受信装置２０１Ｂでは、第１の送受信装置２０１Ａからの送信信号の検出が完了すると、制御回路２１１Ｂは記憶回路２１２Ｂに記憶されている通信周波数リストを読み出すとともに可変アッテネータ２１８Ｂの減衰を最大に設定した後、ＲＦコンバータ２０２Ｂを動作させる。

【０１１４】さらに、制御回路２１１Ｂは、読み出した通信周波数リストの範囲内を、例えば表２の第２列に示すような高い方から低い方、もしくは低い方から高い方へ単一方向に、さらに通信周波数リストの最後に達した時はリストの最後に戻るように変化する周波数切り替え順序で、かつ第１の送受信装置の送信周波数とは常に異なり、さらに受信している周波数のイメージ周波数でない周波数を使用するような周波数時間割を使用して、ＲＦコンバータ２０２ＢのＲＦ周波数を高速に切り換える。これにより、電力スペクトルを拡散した後、可変アッテネータ２１８Ｂの減衰量を小さくして送信を開始する。

【０１１５】なお、表２に示した周波数の切り換え順序は、第１の送受信装置２０１Ａと第２の送受信装置２０１Ｂで予め取り決めているものが使用される。また、通信周波数は検出が完了した第１の送受信装置２０１Ａから送られてきた映像信号の同期タイミングに合わせて切り換えられる。

【０１１６】ここで、他の無線機器への影響を防止し電波の有効利用を図るには、送信される単位帯域幅当りのＲＦ電力密度を図３に示す散弱レベル３０４以下にする必要があり、よって制御回路２１１Ｂは通信周波数リストから使用周波数の帯域幅および電力スペクトルの拡散

率を求め、これにより単位帯域幅当りのＲＦ電力密度を一定にするように可変アッテネータ２１８Ｄの減衰量を調整する。

【０１１７】一方、第１の送受信装置２０１Ａでは、送信を開始してから予め定められた一定時間経過後にＲＦチューナ２０３Ａを動作させる。さらに、第１の送受信装置２０１Ａの制御回路２１１Ａは通信周波数リストの範囲内を、表２の第２列に示す周波数の切り替え順序により、また周波数の切り換えタイミングは送信している映像信号の周期タイミングを使用し、ＲＦチューナ２０３Ａの受信周波数を高速に切り換えて第２の送受信装置２０１Ｂからの信号を受信する。

【０１１８】ここで、第１の送受信装置２０１Ａで受信を開始してすぐの期間には、送信周波数と受信周波数は必ずしも時間的に一致していないことから、第１の送受信装置のＲＦチューナ２０３Ａの映像出力およびコンバレータ２２５Ａの出力には信号は現れていない。よって、第１の送受信装置２０１Ａの制御回路２１１Ａは、コンパレータ２２５Ａの出力をモニタしながら、受信周波数の時間割スタート時刻を順次変化させることで第２の送受信装置２０１Ｂからの送信信号の検出を試みる。ここで、第２の送受信装置の送信周波数の時間割周期は一定であることから、第１の送受信装置では一定の試行の後、第２の送受信装置の送信信号の検出に成功する。以上により、第１および第２の送受信装置間で複信での通信が実現される。

【０１１９】一般に広い帯域を使用する無線伝送の受信レベルは、マルチパスや送受信アンテナの周波数特性の影響を受け、図７に示す受信レベル特性４０６のように大きく変化し、受信レベルが通信限界レベル４０７以下となる周波数では、映像信号が再生できない。

【０１２０】上記のように第１および第２の送受信装置間で複信の通信が実現されると、マルチパスや送受信アンテナの周波数特性の影響等により受信レベルが通信限界レベル以下となる周波数情報の交換が可能となる。

【０１２１】第２の送受信装置２０１Ｂでは、制御回路２１１Ｂにより疑似映像信号を発生し、図９に示すように垂直帰線消去期間の映像信号上に、通信限界レベル以下となる周波数の情報をデータ６０５の部分に合成器２１６を用いて重畳し、第１の送受信装置２０１Ａへ返信する。さらに第２の送受信装置２０１Ｂでは通信周波数リストを複製した第２の通信周波数リストを作成し、通信限界レベル以下となる周波数を第２の通信周波数リストから除外して記憶回路２１２Ｂに記憶する。

【０１２２】第１の送受信装置２０１Ａでは返信されてきた通信限界レベル以下となる周波数情報を確認すると、通信周波数リストを複製した第２の通信周波数リストを作成する。ただし、返信されてきた通信限界レベル以下となる周波数を第２のリストから除外して記憶回路２１２Ａに記憶するとともに、この第２の通信周波数リストを使用した送信を開始する。

【０１２３】また、第２の送受信装置２０１Ｂでは、通信周波数リストが変わったことで、それまで検出していた第１の送受信装置の送信信号が消失するが、予め定められた一定時間が経過した後、今度は作成しておいた第２の通信周波数リストを使用して、再び第１の送受信装置の送信信号の検出動作および前述した一連の応答動作を行なう。

【０１２４】さらに、第１の送受信装置でも通信周波数リストが変わったことで、それまで検出していた第２の送受信装置の送信信号が消失するが、予め定められた一定時間が経過した後、作成しておいた第２の通信周波数リストを使用して、再び第２の送受信装置の送信信号の検出動作を行ない、複信の通信を再確立させる。

【０１２５】また、使用中に第１もしくは第２の送受信装置の位置が変化したり、マルチパスの状況が変化したりして、通信限界レベル以下となる周波数が変化した場合には、それを検出した第１の送受信装置２０１Ａは、使用する通信周波数リストを第２の通信周波数リストから、元の通信周波数リストへ換えて送信を開始する。

【０１２６】ここで、第２の送受信装置では、通信周波数リストが変わったことで、それまで検出していた第１の送受信装置の送信信号が消失するが、予め定められた一定時間が経過した後、使用する通信周波数リストを第２の通信周波数リストから元の通信周波数リストに換えて、再び第１の送受信装置の送信信号の検出動作および前述した一連の応答動作を行なうとともに、自装置からの送信についても、使用する通信周波数リストを第２の通信周波数リストから、元の通信周波数リストへ換えて送信を開始する。

【０１２７】また、第１の送受信装置２０１Ａでは、通信周波数リストが変わったことで、それまで検出していた第２の送受信装置の送信信号が消失するが、予め定められた一定時間が経過した後、使用する通信周波数リストを第２の通信周波数リストから、元の通信周波数リストへ換えて再び第２の送受信装置の送信信号の検出動作を行ない、複信の通信を再確立させる。

【０１２８】元の通信周波数リストを使用した複信の通信が再確立された後は、通信の初期状態に戻っていることから、前述した一連の処理および動作により、新たに通信限界レベル以下となる周波数の情報交換を行ない、その情報を使用して更新した前記第２の通信周波数リストを使用した複信の通信の再確立動作を行なう。

【０１２９】ここで、上記第２の通信周波数リストを作成および更新して使用する動作においては、前述同様に第１および第２に送受信装置とも、使用周波数帯域幅と電力スペクトル拡散率から、単位帯域幅当りのＲＦ電力密度の制御を自動的に行なうものとする。

【０１３０】以上のように、単向の通信ではマルチパスや送受信アンテナの周波数特性の影響により、図８

（ｂ）に示すように映像信号の一部の再生ができず、使用感が悪かったものが、視信の通信が可能となったことで通信限界レベル以下となる周波数を使用しないで通信することができるので、図８（ｃ）に示すように、マルチパスや送受信アンテナの周波数特性の影響を解消した映像伝送が可能となる。

【０１３１】さらに、実施の形態１と同様、一般に、他の無線機器への影響を防止し電波の有効利用を図るために、微弱電波を使用する無線送信装置は、一定距離だけ離れた地点での電界強度の上限が制限されている。その上限は既存の同じ周波数帯を使用する他の無線機器に対する影響の度合いで決定され、その検査測定方法は影響を受ける可能性がある側の無線機器の方式を基準に決定される。なお、一定距離だけ離れた地点での電界強度の制御は、機器に固定の送信アンテナを使用する場合では送信電力を制御することで実現できる。

【０１３２】また、単一周波数を使用する方式の無線機器同士、およびスペクトルを拡散して使用する方式の無線機器同士の相互影響は大きいが、両方式間での相互影響は小さいという手段があるが、本実施の形態の伝送装置については、標準テレビジョン放送の周波数帯を使用するものであり、既存の他の無線機器は単一周波数を使用するテレビジョン受像機である。

【０１３３】以上の理由から、標準テレビジョン放送の周波数帯を使用し、スペクトルを拡散して送信する本実施の形態の伝送装置では、従来の単一周波数を使用する方式に比べて大きな出力電力での送信が可能であり、これに伴って受信電力も増加するので伝送距離も長くなる。

【０１３４】さらに、本実施の形態３の映像伝送装置では、使用に先立って映像伝送に使用可能な周波数を検出登録して使用するために、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存が可能となっている。

【０１３５】また実施の形態１と同様に、音声信号のＰＣＭ伝送も可能なので高品位な双方向音声伝送が実現される。さらに、実施の形態２と同様に、図６のデータ６０５の部分に周辺受信装置に接続されている外部機器の制御信号を重畳して双方向に伝送できるので、さらに高機能な映像伝送装置が実現できる。

【０１３６】このように、本実施の形態３の伝送装置によれば、実施の形態２の伝送装置における送信装置と受信装置を併せ持つ第１および第２の送受信装置が、それぞれ、周波数切り換え順序を前記通信周波数リストの範囲内で高い方から低い方、もしくは低い方から高い方へ単一方向に行なうとともに、前記周波数リストの最後に達した時は前記周波数リストの最初へ戻り、かつ前記第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間制を用いることで複信で通信するようにしたので、テレビジョン放送の受信機能も有し、各送受信装置間で相互に制御可能な高機能で、安価な複信映像伝送装置を実現することができる。

【０１３７】また、通信開始時には登録してある前記通信周波数リストを使用し、通信開始後は前記通信周波数リストを複製した第２の通信周波数リストを使用するとともに、前記第２の通信周波数リストは通信の良否結果情報を前記２組の送受信装置間で交換することにより随時更新するようにしたので、マルチパスの影響を解消した映像伝送装置を実現することができる。

【０１３８】従って、複信での映像伝送を実現し、マルチパスの影響を解消することができ、カメラをリモート操作する警備用監視カメラ等に応用することが可能である。また、本実施の形態３ではデジタル化された音声信号をＰＣＭ化するようにした場合を示したが、他の圧縮符号化方式を用いることも可能である。さらに、本実施の形態３では標準テレビジョン信号としてＮＴＳＣ方式を用いるようにした場合を示したが、ＰＡＬ方式やＳＥＣＡＭ方式を用いることも可能である。

【０１３９】（実施の形態４）この実施の形態４は、集合住宅で複数の伝送装置を使用する場合などの状況において、做弱電波の傍受を防止できるようにしたものである。以下、本発明の実施の形態４について、図５、図６、図７および表３を用いて説明する。この実施の形態４は、本願の請求項１０ないし請求項１２および請求項２２ないし請求項２４に記載された発明に対応している。図５は本発明の実施の形態４による伝送装置の構成を示している。また、図６は本発明の実施の形態４における映像信号を示している。また、図７は本発明の実施の形態４における、使用電波エリアが不確定に重なっている集合住宅での使用状態を示している。また、表３は本発明の実施の形態４の周波数切り替え順序、および周波数時間割を示している。

【０１４０】

【表３】

C→D	D→C	E→F	F→E	A→B	B→A
f_1	f_{n-1}	f_n	f_{n-2}	f_{n-3}	f_{n-4}
f_2	f_n	f_1	f_{n-1}	f_{n-2}	f_{n-3}
f_3	f_1	f_2	f_n	f_{n-1}	f_{n-2}
f_4	f_2	f_3	f_1	f_n	f_{n-1}
f_5	f_3	f_4	f_2	f_1	f_n
⋮	⋮	⋮	⋮	⋮	⋮
f_n	f_{n-2}	f_{n-1}	f_{n-3}	f_{n-4}	f_{n-5}
f_1	f_{n-1}	f_n	f_{n-2}	f_{n-3}	f_{n-4}
f_2	f_n	f_1	f_{n-1}	f_{n-2}	f_{n-3}
⋮	⋮	⋮	⋮	⋮	⋮

時間

図において、５２０は請求項１０に記載されたＩＤ記憶手段である，このＩＤ記憶手段５２０は製造時に付加されるＩＤを記憶するものであり、通信端子２０７Ａ，２０７Ｂと制御回路２１１Ａ，２１１Ｂと記憶回路２１２Ａ，２１２Ｂとで構成される。

【０１４１】また、５２１は請求項１０に記載されたＩＤ照会登録手段である。このＩＤ照会登録手段５２１は、使用に先立ち通信を許可する別装置との間でたがいにＩＤを照会しあい登録しておくものであり、検出登録ボタン２０６Ａ，２０６Ｂと通信端子２０７Ａ，２０７Ｂと制御回路２１１Ａ，２１１Ｂと記憶回路２１２Ａ，２１２Ｂとで構成される。

【０１４２】また、５２２は請求項１１に記載された周波数設定手段である。この周波数設定手段５２２は送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の別装置すべての周波数時間割を検出し、これら別装置と常に使用周波数が異なるような周波数時間割を用いて送信を行なうものであり、ＲＦチューナ２０３Ａ，２０３Ｂとコンパレータ２２５Ａ，２２５Ｂと制御回路２１１Ａ，２１１Ｂと記憶回路２１２Ａ，２１２Ｂとで構成される。

【０１４３】また、５２３は請求項１１に記載された再送信手段である。この再送信手段５２３は送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なうものであり、送受信アンテナ２１９Ａ，２１９ＢとＲＦチューナ２０３Ａ，２０３Ｂとコンパレータ２２５Ａ，２２５Ｂと制御回路２１１Ａ，２１１Ｂと記憶回路２１２Ａ，２１２Ｂとで構成される。

【０１４４】また、５２４は請求項１２に記載された出力停止手段である。この出力停止手段５２４は受信モードでは通信を許可するＩＤが確認できない時には音声および映像を出力させないものであり、制御回路２１１Ａ，２１１ＢとコンパレータＡ２２５Ａ，２２５Ｂと記憶回路２１２Ａ，２１２Ｂと音声映像出力回路２２７Ａ，２２７Ｂとで構成される。

【０１４５】この図５において、第１および第２の送受信装置２０１Ａと２０１Ｂは、少なくとも実施の形態３と同じ装置や手段を有し、さらに少なくとも実施の形態３に示した動作を全て行なうように構成されている。ここで、第１および第２の送受信装置２０１Ａと２０１Ｂには、製造時にＩＤ付与装置が外部機器接続端子２０８Ａ，２０８Ｂに接続されて、各装置に固有のＩＤが入力される。ＩＤが入力されると制御装置２１１Ａ，２１１Ｂは、与えられたＩＤを記憶回路２１２Ａ，２１２Ｂに記憶する。

【０１４６】また、第１および第２の送受信装置２０１Ａと２０１Ｂには、通信を許可する別装置の登録が以下のように行われる。第１の送受信装置２０１Ａと第２の送受信装置２０１Ｂが通信端子２０７Ａ，２０７Ｂで接続された後、検出登録ボタン２０６Ａ，２０６Ｂのどちらか一方が押されると、一方の制御回路２１１Ａは通信端子２０７Ａを介して、第２の送受信装置の制御回路２１１ＢにＩＤの要求信号を送出する。

【０１４７】以下、検出登録ボタン２０６Ａが押されたとして説明する。ＩＤの要求信号を受けた第２の送受信装置２０１Ｂの制御回路２１１Ｂは、記憶回路２１２Ｂに記憶されている自装置に固有なＩＤを読み出し、これを通信端子２０７Ｂを介して第１の送受信装置２０１Ａに送出する。

【０１４８】第２の送受信装置２０１ＢのＩＤを受けた第１の送受信装置２０１Ａの制御回路２１１Ａは、受けたＩＤを通信を許可する別装置のＩＤとして記憶回路２１２Ａに記憶する。これとともに、自装置に固有なＩＤを通信端子２０７Ａを介して第２の送受信装置２０１Ｂに向けて送出する。

【０１４９】第１の送受信装置２０１ＡのＩＤを受けた第２の送受信装置２０１Ｂの制御回路２１２Ｂは、受けたＩＤを通信を許可する別装置のＩＤとして記憶回路２１２Ｂに記憶する。以上で、第１および第２の送受信装置２０１Ａ，２０１Ｂはともに、通信を許可する別装置の登録を完了する。

【０１５０】図１０において、送受信装置Ａと送受信装置Ｂ、送受信装置Ｃと送受信装置Ｄ、送受信装置ＥとＦ送受信装置Ｆの各組は互いに相手の送受信装置を通信を許可する別装置として各送受信扇の登録が完了している。この図では、現在ＣとＤおよびＥとＦが表３の第１列か

ら第N列までの周波数時間割を使用して通信している状態にある。また、図10において、a，b，c，d，e，fはそれぞれ送受信装置A，B，C，D，E，Fの電波の到達エリアを示している。上記状態において、送受信装置Aが送受信装置Bに向けて呼出および映像・音声の伝送を行ない、さらに送受信装置Bが送受信装置Aに応答および映像・音声の伝送を行なう動作を以下に説明する。なお、送受信装置Aと送受信装置Bは、図5の送受信装置201Aと送受信装置201Bにそれぞれ対応している。

【0151】図5において、送受信装置201Aの外部機器制御端子208Aには外部機器からの映像伝送リクエスト信号が、さらに映像入力端子204Aには外部機器からの映像信号が入力されると、制御回路211Aは記憶回路212Aに記憶されている通信周波数リストを読み出すとともに、RFチューナ203Aを動作させて、送信モードの前に受信モードを実行する。

【0152】受信モードでは、送受信装置201Aの制御回路211Aは読み出した通信周波数リストの範囲内を、表3の第五列に示す周波数の切り替え順序により、また周波数の切り換えタイミングは制御回路211Aの内部で発生する疑似周期タイミングを使用し、RFチューナ203Aの受信周波数を高速に切り換えて同一電波エリア内で送信中の別装置からのRF信号を受信する。

【0153】ここで、図10に示すように、送受信装置Aの周囲には、送受信装置BおよびCが電波到達エリア内に、また送受信装置DおよびEおよびFが電波到達エリア外に存在し、さらに送受信装置Bの周囲には、送受信装置AおよびEが電波到達エリア内に、また送受信装置CおよびDおよびFが電波到達エリア外に存在している。また、送信中である送受信装置C，D，E，Fは、それぞれ通信を許可する別装置を検出し合うために、送信映像信号上の図6に示すデータ605の部分に、それぞれ自装置に固有なIDを重畳して送信している。

【0154】まず、送受信装置201Aで受信を開始してすぐの期間には、周囲の送受信装置が送信する映像信号の同期タイミングと受信側の疑似同期タイミングは必ずしも一致していない。さらに、送信周波数と受信周波数も必ずしも時間的に一致していないことから、RFチューナ203Aの映像出力およびコンパレータ225Aの出力には信号は現れていない。

【0155】よって、送受信装置201Aの制御回路211Aは、コンパレータ225Aの出力をモニタしながら、疑似同期タイミングと受信周波数の時間割スタート時刻を順次変化させることで周囲の送受信装置の送信信号の検出を試みる。

【0156】ここで、送受信装置Aの周囲電波到達エリアでは送受信装置Cが表3の第1列、即ち左端の列に示す周波数時間割を用いて送信を行なっており、送受信装置Cの送信する映像信号の同期タイミングと送信周波数の時間割周期は一定であることから、送受信装置Aでは一定の試行の後、送受信装置Cの送信信号の検出に成功する。

【0157】送信信号の検出に成功すると、送受信装置AはコンパレータA225Aにより抽出された受信映像信号の同期タイミングを疑似同期タイミングに換えて使用する。これとともに、コンパレータ225Aにより図6のデータ605の部分を抽出して、この信号を送信している送受信装置に固有なIDを読み取る。そして、読み取ったIDが通信を許可している別装置でない場合は、現在用いている周波数時間割を、周囲の別の送受信装置グループの使用中リストとして、記憶回路212Aに記憶する。

【0158】さらに続けて送受信装置Aは、電波到達エリア内にさらに送信中の別装置がないか否かを、コンパレータ225Aの出力をモニタしながら、疑似同期タイミングと受信周波数の時間割スタート時刻を順次変化させることで周囲の送受信装置の送信信号の検出を試みる。

【0159】ここで、疑似同期タイミングと受信周波数の時間割スタート時刻を一通り変化させて、送信信号の検出の後、送受信装置C以外に周囲に別装置がないことが判明すると、送受信装置Aの制御回路211Aは、記憶しておいた使用中リスト以外、例えば表3の第三列の周波数時間割を用いて、RFコンバータ202AのRF周波数を高速に切り換えることで電力スペクトルを拡散した後、可変アッテネータ218Aの減衰量を小さくして送信を開始する送信を開始する。

【0160】一方、図5において、送受信装置201Bの外部機器制御端子208Bに、外部機器から映像受信のリクエスト信号が入力されると、送受信装置の制御回路208Bは記憶回路212Bに記憶されている通信周波数リストを読み出すとともに、RFチューナ203Bを動作させる。

【0161】さらに、送受信装置201Bの制御回路211Bは読み出した通信周波数リストの範囲内を、表3の第6列に示す周波数の切り替え順序により、また周波数の切り換えタイミングは制御回路211B内部で発生する疑似同期タイミングを使用し、RFチューナ203Bの受信周波数を高速に切り換えて送受信装置AからのRF信号を受信する。

【0162】ここで、送受信装置Bで受信を開始してすぐの期間には、送信側の映像信号の同期タイミングと受信側の疑似同期タイミングは必ずしも一致していない。さらに送信周波数と受信周波数も必ずしも時間的に一致していないことから、RFチューナ203Bの映像出力およびコンパレータ225Bの出力には信号は現れていない。よって、送受信装置201Bの制御回路211Bは、コンパレータ225Bの出力をモニタしながら、疑似同期タイミングと受信周波数の時間割スタート時刻を

順次変化させることで送受信装置Aの送信信号の検出を試みる。

【0163】ここで、送受信装置Bの周囲電波到達エリアでは送受信装置Aおよび送受信装置Eが、ともに表3の第三列に示す周波数時間割を用いて送信を行なっているものとする。送受信装置A・Eの送信する映像信号の同期タイミングと送信周波数の時間割周期は一定であることから、送受信装置Bでは一定の試行の後、送受信装置A・E両方からの送信信号を検出する。

【0164】送信信号の検出に成功すると、送受信装置Bはコンパレータ225Bにより受信映像信号の同期タイミングを抽出しようと試みる。しかしながら、受信信号は送受信装置A，Eの信号が重なり、相互干渉しているため、正常な同期信号の周期とはならない。よって送受信装置Bでは応答のための、送信は行なわず、さらに別の送信信号の検出動作に入る。

【0165】送受信装置Aでは、送信を開始した後、RFチューナを使用して受信モードを維続しているが、予め定められた時間を経過しても通信を要求した送受信装置Bからの応答信号を検出できない。このため、送受信装置Aは、使用中リストとは異なり、さらに今使用しているものとは異なる周波数時間割、例えば表3の第五列に示す周波数時間割を使用して再び送信を開始する。送受信装置Bでは、別の送信信号の検出動作を継続しているので、今度は送受信装置Bとは異なる周波数時間割を使用する送受信装置Aからの送信信号を正常に検出する。

【0166】検出に成功すると、送受信装置Bはコンパレータ225Bにより抽出された受信映像信号の同期タイミングを疑似同期タイミングに換えて使用する。検出に成功すると、送受信装置Bはコンパレータ225Bにより抽出された受信映像信号の同期タイミングを疑似同期タイミングに換えて使用する。これとともに、送受信装置Bはさらにコンパレータ225Bにより図6のデータ605の部分を抽出して、この信号を送信している送受信装置に固有なIDを読み取る。そして、読み取ったIDから現在受信している信号が、通信を許可している送受信装置Aからの信号であることを確認する。

【0167】また、送受信装置Bでは、送受信装置Aからの送信信号の検出とIDの確認が完了すると、制御回路211Bは記憶回路212Bに記憶されている通信周波数リストを読み出すとともに可変アッテネータ218Bの減衰量を最大に設定した後、RFコンバータ202Bを動作させる。

【0168】さらに、制御回路211Bは、読み出した通信周波数リストの範囲内を、例えば表3の第六列に示す周波数時間割を用いて、RFコンバータ202BのRF周波数を高速に切り換えることで電力スペクトルを拡散した後、可変アッテネータ218Bの減衰量を小さくして送信を開始する。

【0169】また、通信周波数は検出が完了した送受信装置Aから送られてきた映像信号の同期タイミングに合わせて切り換えられる。一方、送受信装置Aでは、RFチューナを使用して受信モードを継続しているので送受信装置Bからの応答信号を検出する。

【0170】ここで、送受信装置Bからの応答信号は表3に示すように、送受信装置Aの周囲電波到達エリア内にある別の送受信装置グループが使用している周波数時間割とは異なるために、良好な受信となる。

【0171】送信信号の検出に成功すると、送受信装置Aは受信映像信号に重畳されている応答信号を抽出しようと試みる。そして良好な受信状態にある受信映像信号からは正常な応答信号が確認されるので、送受信装置Aでは、複信通信成功の応答を既に送信中である映像信号に重畳して送り出す。送受信装置Bでは、複信通信成功の応答信号を確認すると、以後使用する周波数時間割を固定して通信路を確保する。

【0172】なお、上記過程において、送受信装置Bが使用する周波数時間割が例えば表3の第1列の周波数時間割と重なった場合は、送受信装置Aでは Bからの応答信号を確認できず、複信通信成功の応答信号も送信しない。送受信装置Bでは、予め定められた時間が経過しても、送受信装置Aからの複信通信成功の応答信号を確認できないので、さらに異なる周波数時間割、例えば表3の第6列の周波数時間割を用いて送信を開始することで、上記良好な受信状態に帰着する。

【0173】さらに、上記過程において、送受信装置グループCDと送受信装置グループABで通信周波数リストが異なる場合は、同じ周波数を同時に使用している時間比率に応じて相互干渉が減少するため、実質上相互影響は発生せず、周囲に送信中である別の送受信装置グループがないのと同じ状態となり、良好な通信が可能となる。以上により、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消することが可能となる。

【0174】また、上記過程において、送受信装置AおよびBは、それぞれ送受信装置CおよびEの送信信号を検出する可能性があるが、受信映像信号上に重畳されているIDが、通信を許可している別装置からのものであることが確認できない時は、図5の音声映像出力回路227Aおよび227Bにより音声、映像信号を出力しない。これにより、ユーザーの意図に関わらず、傍受を防止することが可能となる。

【0175】このように、本実施の形態4の伝送装置によれば、実施の形態2または3の伝送装置において、製造時に付加されるIDを記憶し、使用に先立ち通信を許可する別装置との間で互いにIDを照会しあい登録しておくようにしたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止した映像伝送装置を実現することができる。

【０１７６】また、送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の別装置すべての周波数時間割を検出し、これら別装置と常に使用周波数が異なるような周波数時間割を用いて送信を行ない、送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なうようにしたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消した映像伝送装置を実現することができる。

【０１７７】また、受信モードでは通信を許可するＩＤが確認できない時には、音声および映像を出力しないようにしたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、傍受を防止した映像伝送装置を実現することができる。従って、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止することができ、玄関テレホンやテレビ電話の室内ワイヤレス端末等に応用することが可能である。

【０１７８】なお、本実施の形態４では既にデジタル化された音声信号をＰＣＭ化するようにした場合を示したが、他の圧縮符号化方式を用いることも可能である。さらに、本実施の形態４では標準テレビジョン信号としてＮＴＳＣ方式を用いるようにした場合を示したが、ＰＡＬ方式やＳＥＣＡＭ方式を用いることも可能である。

【０１７９】

【発明の効果】以上のように、本発明の請求項１に記載の発明に係る伝送装置によれば、微弱電波を利用して映像または音声を伝送する発信局と、微弱電波を利用して映像または音声を伝送する着信局と、前記微弱電波の到達距離を超えて配置した前記発信局と着信局との間に配置した中継局とを備え、前記発信局からの送信信号には、映像や音声などの本来の情報に加え、着信局の宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含み、前記中継局は、前記発信局から受信した微弱電波の周波数とは異なる周波数に変調して出力するとともに、着信局側から自局が受信する周波数の情報を付加して送信し、前記着信局は、自局宛の信号であることを認識すると、前記中継局の指定した周波数に微弱電波を変調して映像や音声を送信することにより、発信局と着信局との伝送路を確立するようにしたので、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送が可能となる効果がある。

【０１８０】また、本発明の請求項２に記載の発明に係る伝送装置によれば、請求項１記載の伝送装置において、前記発信局から前記着信局へ向けた往路の送信信号には、標準テレビジョン信号を使用し、映像信号の垂直帰線消去期間に、ＰＣＭ音声信号と着信局の宛先や自局の指定する受信周波数を示す情報を重畳するようにしたので、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送が可能となる効果がある。

【０１８１】また、本発明の請求項３に記載の発明に係る伝送装置によれば、標準テレビジョン信号を発生するＲＦコンバータを備えた送信装置と、標準テレビジョン信号を受信するＲＦチューナを備えた受信装置と、使用に先立って前記ＲＦチューナの受信帯域内で映像伝送に使用可能な周波数を検出する使用可能周波数検出手段と、検出した周波数を通信周波数リストとして前記送受信装置双方に登録する検出周波数登録手段と、前記通信周波数リストの範囲内で周波数を切り換えることにより電力スペクトルを拡散して通信を行うスペクトル拡散通信手段とを備えるようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる効果がある。

【０１８２】また、本発明の請求項４に記載の発明に係る伝送装置によれば、請求項３記載の伝送装置において、単位帯域幅当りの電力密度が一定になるように、前記通信の際の送信電力を使用周波数帯域幅に応じて自動的に変化させる送信電力制御手段を備えたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる効果がある。

【０１８３】また、本発明の請求項５に記載の発明に係る伝送装置によれば、請求項３または４記載の伝送装置において、映像信号の同期タイミングに同期して前記通信の際の周波数を切り換える周波数切り替え手段を備えるようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送装置を提供できる効果がある。

【０１８４】また、本発明の請求項６に記載の発明に係る伝送装置によれば、請求項３ないし５のいずれかに記載の伝送装置において、前記通信の際に、制御信号を帰線消去期間の映像信号上に重畳して伝送する制御信号重畳伝送手段を備えるようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デ

ジタルテレビジョン放送や移動体通信機器が周波帯域を使用するようになっても共存可能な映像伝送装置を提供できる効果がある。

【０１８５】また、本発明の請求項７に記載の発明に係る伝送装置によれば、請求項３ないし６のいずれかに記載の伝送装置において、前記通信の際に、音声信号をＰＣＭ化し、帰線消去期間の映像信号上に重畳して伝送する音声信号重畳伝送手段を備えるようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来ディジタルテレビジョン放送や移動体通信機器が周波帯域を使用するようになっても共存可能な映像伝送装置を提供できる効果がある。

【０１８６】また、本発明の請求項８に記載の発明に係る伝送装置によれば、それぞれ請求項３ないし７のいずれかに記載された伝送装置からなる第１および第２の送受信装置と、前記通信の際に、前記通信周波数リストの範囲内で周波数の高い方から低い方、もしくは低い方から高い方へ単一方向に周波数切り換えを行なうとともに、周波数が前記周波数リストの最後に達した時は前記周波数リストの最初へ戻すように周波数切り換え順序を制御する周波数切り替え順序制御手段と、前記第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間割を用いることにより、複信で通信を行うように制御を行う通信制御手段とを備えるようにしたので、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送装置を提供できる効果がある。

【０１８７】また、本発明の請求項９に記載の発明に係る伝送装置によれば、請求項８記載の伝送装置において、前記通信の開始時には事前に登録してある前記通信周波数リストを使用し、通信開始後は前記通信周波数リストを複製した第２の通信周波数リストを使用するとともに、通信の良否結果情報を前記２組の送受信装置間で交換することにより前記第２の通信周波数リストを随時更新する通信周波数リスト更新手段を備えたので、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送装置を提供できる効果がある。

【０１８８】また、本発明の請求項１０に記載の発明に係る伝送装置によれば、請求項３ないし９のいずれかに記載された伝送装置において、製造時に伝送装置に付加される識別番号（以下、ＩＤと称す）を記憶するＩＤ記憶手段と、使用に先立ち通信を許可する他の伝送装置との間で互いにＩＤを照会しあい登録しておくＩＤ照会登録手段とを備えたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送装置を提供できる効果がある。

【０１８９】また、本発明の請求項１１に記載の発明に係る伝送装置によれば、請求項１０記載の伝送装置において、送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の他のすべての伝送装置の周波数時間割を検出し、これら他のすべての伝送装置と常に使用周波数が異なるよう周波数時間割を用いて送信を行なう周波数設定手段と、送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なう再送信手段とを備えたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送装置を提供できる効果がある。

【０１９０】さらに、本発明の請求項１２に記載の発明に係る伝送装置によれば、請求項１０または１１記載の伝送装置において、受信モードでは通信を許可するＩＤが確認できない時には、音声または映像などの本来の情報を出力させない出力停止手段を備えたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送装置を提供できる効果がある。

【０１９１】また、本発明の請求項１３に記載の発明に係る伝送方法によれば、微弱電波を利用して発信局と着信局との間で映像または音声を相互に伝送するための伝送方法であって、前記微弱電波の到達距離を超えて配置した前記発信局と着信局との間に中継局を配置し、前記発信局からの送信信号には、映像や音声などの本来の情報に加え、着信局の宛先を示す情報と、自局が中継局から受信する周波数を示す情報とを含み、前記中継局は、前記発信局から受信した微弱電波の周波数とは異なる周波数に変調して出力するとともに、着信局側から自局が受信する周波数の情報を付加して送信し、前記着信局は、自局宛の信号であることを認識すると、前記中継局の指定した周波数に微弱電波を変調して映像や音声を送信することにより、発信局と着信局との伝送路を確立するようにしたので、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送を可能にする効果がある。

【０１９２】また、本発明の請求項１４に記載の発明に係る伝送装置によれば、請求項１３記載の伝送方法において、前記発信局から前記着信局へ向けた往路の送信信号には、標準テレビジョン信号を使用し、映像信号の垂直帰線消去期間に、ＰＣＭ音声信号と着信局の宛先や自局の指定する受信周波数を示す情報を重畳するようにしたので、微弱電波を利用して映像や音声を伝送する際に、発信局と着信局の距離が微弱電波の到達距離を越える場合の伝送を可能にする効果がある。

【０１９３】また、本発明の請求項１５に記載の発明に係る伝送方法によれば、標準テレビジョン信号を発生するＲＦコンバータを備えた送信装置と、標準テレビジョン信号を受信するＲＦチューナを備えた受信装置との間で伝送を行う方法であって、使用に先立って前記ＲＦチ

ューナの受信帯域内で映像伝送に使用可能な周波数を検出し、検出した周波数を通信周波数リストとして前記送受信装置双方に登録し、前記通信周波数リストの範囲内で周波数を切り換えることにより電力スペクトルを拡散して通信を行うようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる効果がある。

【０１９４】また、本発明の請求項１６に記載の発明に係る伝送方法によれば、請求項１５記載の伝送方法において、単位帯域幅当りの電力密度が一定になるように、前記通信の際の送信電力を使用周波数帯域幅に応じて自動的に変化させるようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる効果がある。

【０１９５】また、本発明の請求項１７に記載の発明に係る伝送方法によれば、請求項１５または１６記載の伝送方法において、映像信号の同期タイミングに同期して前記通信の際の周波数を切り換えるようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送と高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる効果がある。

【０１９６】また、本発明の請求項１８に記載の発明に係る伝送方法によれば、請求項１５ないし１７のいずれかに記載の伝送方法において、前記通信の際に、制御信号を帰線消去期間の映像信号上に重畳して伝送するようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高機能化が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる効果がある。

【０１９７】また、本発明の請求項１９に記載の発明に係る伝送方法によれば、請求項１５ないし１８のいずれかに記載の伝送方法において、前記通信の際に、音声信号をＰＣＭ化し、帰線消去期間の映像信号上に重畳して伝送するようにしたので、ＮＴＳＣ方式の標準テレビジョン放送受信機能を有するとともに、マルチパスの影響を軽減し、高品位な音声伝送が可能で、単一周波数を使用する場合よりも長距離の通信距離を実現し、将来デジタルテレビジョン放送や移動体通信機器が同帯域を使用するようになっても共存可能な映像伝送方法を提供できる効果がある。

【０１９８】また、本発明の請求項２０に記載の発明に係る伝送方法によれば、第１および第２の送受信装置はそれぞれ請求項１５ないし１９のいずれかに記載された伝送方法を実行するとともに、前記通信の際に、前記通信周波数リストの範囲内で周波数の高い方から低い方、もしくは低い方から高い方へ単一方向に周波数切り換えを行なうとともに、周波数が前記周波数リストの最後に達した時は前記周波数リストの最初へ戻すように周波数切り換え順序を制御し、前記第１および第２の送受信装置は常に異なる周波数を使用するような周波数時間割を用いることにより、複信で通信を行うように制御を行うようにしたので、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送方法を提供できる効果がある。

【０１９９】また、本発明の請求項２１に記載の発明に係る伝送方法によれば、請求項２０記載の伝送方法において、前記通信の開始時には事前に登録してある前記通信周波数リストを使用し、通信開始後は前記通信周波数リストを複製した第２の通信周波数リストを使用するとともに、通信の良否結果情報を前記２組の送受信装置間で交換することにより前記第２の通信周波数リストを随時更新するようにしたので、複信での映像伝送を実現するとともに、マルチパスの影響を解消した映像伝送方法を提供できる効果がある。

【０２００】また、本発明の請求項２２に記載の発明に係る伝送方法によれば、請求項１５ないし２１のいずれかに記載された伝送方法において、製造時に伝送装置に付加される識別番号（以下、ＩＤと称す）を記憶し、使用に先立ち通信を許可する他の伝送装置との間で互いにＩＤを照会しあい登録しておくようにしたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送方法を提供できる効果がある。

【０２０１】また、本発明の請求項２３に記載の発明に係る伝送方法によれば、請求項２２記載の伝送方法において、送信モードの前に必ず受信モードを実行し、同一電波エリア内で送信中の他のすべての伝送装置の周波数時間割を検出し、これら他のすべての伝送装置と常に使用周波数が異なるような周波数時間割を用いて送信を行ない、送信モードを実行した後、予め定められた時間を経過しても通信を要求した別装置からの送信信号を検出できない時は、前記周波数時間割と異なる周波数時間割を用いて再度送信を行なうようにしたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送方法を提供できる効果がある。

【０２０２】さらに、本発明の請求項２４に記載の発明

に係る伝送方法によれば、請求項２２または２３記載の伝送方法において、受信モードでは通信を許可するＩＤが確認できない時には、音声または映像などの本来の情報を出力させないようにしたので、使用電波エリアが不確定に重なる可能性のある集合住宅において、混信を解消し傍受を防止する映像伝送方法を提供できる効果がある。

【図面の簡単な説明】

【図１】図１（ａ）は本発明の実施の形態１における伝送装置の構成図。図１（ｂ）は同伝送装置の各局のブロック図。

【図２】同伝送装置で伝送路を確立する様子を説明する動作説明図。

【図３】同伝送装置における変調信号の波形図。

【図４】本発明の実施の形態２における映像伝送装置の単向通信を実現するブロック図。

【図５】本発明の実施の形態３，４における映像伝送装置の複信通信を実現するブロック図。

【図６】本発明の実施の形態２，３，４における映像伝送装置の信号電力図。

【図７】本発明の実施の形態２，３，４における映像伝送装置の受信レベル図。

【図８】本発明の実施の形態２，３における映像伝送装置の受信映像を示す図。

【図９】本発明の実施の形態２，３における映像伝送装置の映像信号を示す図。

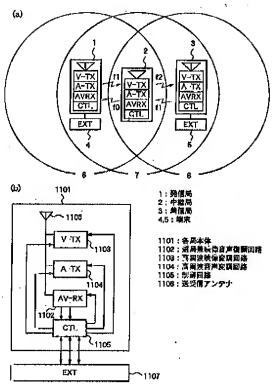
【図１０】本発明の実施の形態４における映像伝送装置の使用電波エリアの重なりを示す図。

【図１１】従来の映像伝送装置の構成を示すブロック図。

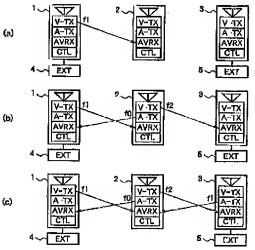
【符号の説明】

１　発信局
２　中継局
３　着信局
４，５　端末
６，７，８　微弱電波の到達範囲
５００　使用可能周波数検出手段
５０１　周波数登録手段
５０２　スペクトル拡散通信手段
５０３　送信電力制御手段
５０４　周波数切り替え手段
５０５　制御信号登録手段
５０６　音声信号重畳制御手段
５１０　周波数切り替え順序制御手段
５１１　通信制御手段
５１２　通信周波数リスト更新手段
５２０　ＩＤ記憶手段
５２１　ＩＤ照会登録手段
５２２　周波数設定手段
５２３　再送信手段
５２４　出力停止手段
１１０１　各局本体
１１０２　選局兼映像音声復調回路
１１０３　高周波映像変調回路
１１０４　高周波音声変調回路
１１０５　制御回路
１１０６　送受信アンテナ
１０１　送信装置
１０２　標準テレビジョン信号を発生するＲＦコンバータ
１０３　通信端子
１０４　外部機器接続端子
１０５　音声入力端子
１０６　映像入力端子
１０７　制御回路
１０８　記憶回路
１０９　ＡＤコンバータ
１１０　コンパレータ
１１１　電圧制御発振器
１１２　合成器
１１３　ミキサ
１１４　可変アッテネータ
１１５　送信アンテナ
１１６　登録ボタン
１１７　受信装置
１１８　標準テレビジョン信号を受信するＲＦチューナ
１１９　通信端子
１２０　外部機器接続端子
１２１　映像出力端子
１２２　音声出力端子
１２３　制御回路
１２４　記憶回路
１２５　ＤＡコンバータ
１２６　コンパレータ
１２７　音声切替えスイッチ
１２８　電圧制御発振器
１２９　ミキサ
１３０　ＡＧＣ回路
１３１　中間周波数処理回路
１３２　受信アンテナ
１３３　検出ボタン

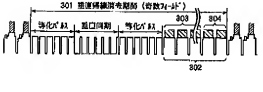
【図１】



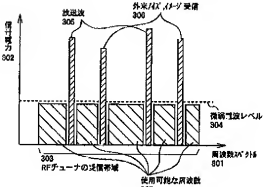
【図２】



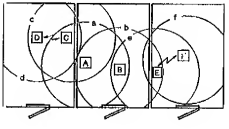
【図３】



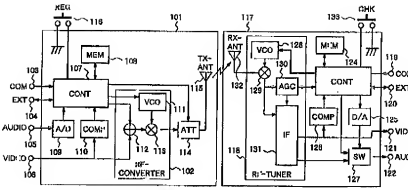
【図６】



【図１０】

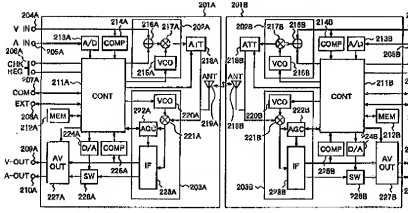


【図4】



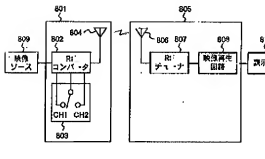
500(116,123,124,126,133)：使用可能周波数検出手段
504(105,111,113,128,107,122)：周波数切り替え手段
505(104,120,107,123,110,126,112)：制御信号重畳手段
506(105,122,109,125,107,123,110,126,112,127)：変調信号重畳制御手段
501(103,113,107,123,108,124,110)：周波数登録手段
502(107,123,106,124,102,118)：スペクトル拡散通信手段
503(107,106,114)：送信電力制御手段
101：送信装置
117：受信装置

【図5】

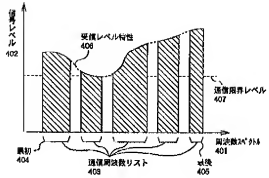


624(211A,211B,225A,225B,212A,212B,22/A,22/B)：出力停止手段
623(219A,219B,203A,203B,225A,225B,211A,211B,212A,212B)：再開信号検
622(203A,203B,216A,225B,211A,211B,213A,213B)：基準数設定手段
620(207A,207B,211A,211B,212A,212B)：ID比較手段
621(206A,206B,207A,207B,211A,211B,217A,217B)：ID照会登録手段
510(211A,212A)：通信開始手段
511(211A,212A)：送信禁止手段
512(211A,212A,214A,225A,216A)：通信周波数リスト更新手段

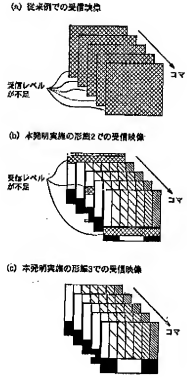
【図11】



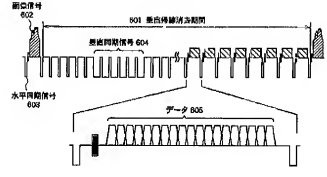
【図7】



【図8】



【図9】



フロントページの続き

(51)Int.Cl.[6]	識別記号	FI	
// H04B 7/26		H04B 7/26	A

1 PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-346356**
(43)Date of publication of application : **14.12.1999**

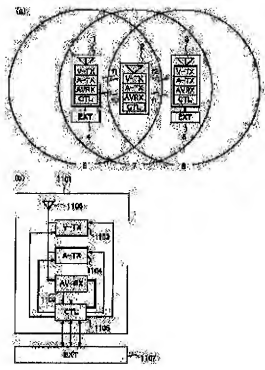
(51)Int.Cl. H04N 7/18
H04N 5/00
H04N 7/00
H04N 7/14
// H04B 7/26

(21)Application number : **11-091618**
(22)Date of filing : **31.03.1999**

(71)Applicant : **MATSUSHITA ELECTRIC IND CO LTD**
(72)Inventor : **KIRINO HIDEKI**
HIRAGA TETSUO

(30)Priority
Priority number : **10 85706** Priority date : **31.03.1998** Priority country : **JP**

(54) **TRANSMITTER AND TRANSMISSION METHOD**



(57)Abstract:
PROBLEM TO BE SOLVED: To attain transmission when a distance between an originating station and a terminating station exceeds the coverage of a weak radio wave by allowing the originating station to transmit a transmission signal by adding information showing the destination of the terminating station and frequencies to be received by its own station from a repeater station, and allowing the repeater station to transmit the transmission signal by adding information showing the frequencies to be received by its own station from the terminating station, and allowing the terminating station to transmit the transmission signal by using the frequencies designated by the repeater station.
SOLUTION: The originating station 1, the repeater station 2, and the terminating station 3 operate transmission and reception with different frequencies. The originating station 1 transmits a signal for calling the terminating station 3 from a terminal 4 with frequencies f1, and designates frequencies to be received by its own station as frequencies f0. The repeater station 2 modulates the received calling signal into frequencies f2, outputs it, and designated frequencies to be received by its own station as the frequencies f1. The terminating station 3 receives the calling signal with the frequencies f2, outputs this to a terminal 5, and outputs a response signal from the terminal 5 with the frequencies f1. The repeater station 2 receives the response signal with the frequencies f1, modulates this signal into the frequencies f0, and outputs it, and the originating station 1 receives it.

CLAIMS

[Claim(s)]
[Claim 1]The sending office which transmits an image or a sound using a feeble radio wave, and a receiving office which transmits an image or a sound using a feeble radio wave, Have a relay station arranged between said sending office and a receiving office which have been arranged exceeding range of said feeble radio wave, and from said sending office to a sending signal. Including information which shows an address of a receiving office in addition to original information, including an image, a sound, etc., and information which shows frequency which a local station receives from a relay station, said relay station, While becoming irregular and outputting to different frequency from frequency of a feeble radio wave which received from said sending office, from the receiving office side, add information on frequency which a local station receives, transmit, and said receiving office, Transmission equipment establishing a transmission line of the sending office and a receiving office by modulating a feeble radio wave in frequency which said relay station specified, and transmitting an image and a sound to it if it recognizes that it is a signal addressed to a local station.
[Claim 2]Transmission equipment superimposing information which shows received frequency which uses a standard television signal for a sending signal of an outward trip turned to said receiving office from said sending office in the transmission equipment according to claim 1, and an address of a PCM sound signal and a receiving office and a local station specify as a vertical

blanking interval of a video signal.
[Claim 3]Transmission equipment comprising:
A sending set provided with an RF converter which generates a standard television signal.
A receiving set provided with RF tuner which receives a standard television signal.
An usable frequency detection means which detects frequency usable to image transmission in a receiving band of said RF tuner in advance of use.
A detection frequency registration means to register with said both transceiving equipment by considering detected frequency as a communication frequency list, and a spread spectrum communication means which communicates by diffusing a power spectrum by switching frequency within the limits of said communication frequency list.

[Claim 4]Transmission equipment having a transmission-power-control means to change automatically transmission power in the case of said communication according to operating frequency band width, in the transmission equipment according to claim 3 so that power flux density per unit bandwidth may become fixed.
[Claim 5]Transmission equipment having a frequency switching means which switches frequency in the case of said communication synchronizing with synchronous timing of a video signal in the transmission equipment according to claim 3 or 4.
[Claim 6]Transmission equipment provided with a control signal superposition transmission means which superimposes a control signal on a video signal of a blanking period, and transmits it in the transmission equipment according to any one of claims 3 to 5 in the case of said communication.
[Claim 7]Transmission equipment provided with an audio signal superposition transmission means which PCM-izes an audio signal, and is superimposed and transmitted on a video signal of a blanking period in the transmission equipment according to any one of claims 3 to 6 in the case of said communication.
[Claim 8]Transmission equipment comprising:
The 1st and 2nd transceiving equipment that consists of transmission equipment indicated to either of claims 3 thru/or 7, respectively.
While performing a frequency change in single direction to the higher one from the lower one or the lower one from the one where frequency is higher within the limits of said communication frequency list in the case of said communication, A frequency change sequence control means to control a frequency change order to return to the beginning of said frequency list when frequency reaches at the end of said frequency list.
A communication control means which controls so that said 1st and 2nd transceiving equipment communicates by duplex operation by using a frequency timetable which uses always different frequency.

[Claim 9]While said communication frequency list registered a priori at the time of a start of said communication is used in the transmission equipment according to claim 8 and after a communication start uses the 2nd communication frequency list that reproduced said communication frequency list, Transmission equipment provided with a communication frequency list update means which updates said 2nd communication frequency list as required by exchanging communicative quality result information among said 2 sets of transceiving equipment.
[Claim 10]Transmission equipment indicated to either of claims 3 thru/or 9, comprising:
An ID storage means which memorizes an identification number (ID is called hereafter) added to transmission equipment at the time of manufacture.
An ID reference registration means to make a reference, to suit and to register ID mutually among other transmission equipment which permits communication in advance of use.

[Claim 11]The transmission equipment comprising according to claim 10:
A frequency setting means which transmits using a frequency timetable in which receiving mode is certainly performed before a transmitting mode, a frequency timetable of other transmission equipment of all the under transmission is detected in the same radio wave area, and using frequency always differs from all the transmission equipment besides these.

A retransmission means which transmits again using a frequency timetable which is [said frequency time] comparatively different when a sending signal from another device which required communication cannot be detected even if time set beforehand passes after performing a transmitting mode.

[Claim 12]Transmission equipment having an output halt means to which original information, including a sound or an image, is not made to output when ID which permits communication in receiving mode cannot be checked in the transmission equipment according to claim 10 or 11.
[Claim 13]It is a transmission method for transmitting an image or a sound mutually between the sending office and a receiving office using a feeble radio wave, Arrange a relay station between said sending office and a receiving office which have been arranged exceeding range of said feeble radio wave, and from said sending office to a sending signal. Including information which shows an address of a receiving office in addition to original information, including an image, a sound, etc., and information which shows frequency which a local station receives from a relay station, said relay station, While becoming irregular and outputting to different frequency from frequency of a feeble radio wave which received from said sending office, from the receiving office side, add information on frequency which a local station receives, transmit, and said receiving office, A transmission method establishing a transmission line of the sending office and a receiving office by modulating a feeble radio wave in frequency which said relay station specified, and transmitting an image and a sound to it if it recognizes that it is a signal addressed to a local station.
[Claim 14]A transmission method superimposing information which shows received frequency which uses a standard television signal for a sending signal of an outward trip turned to said receiving office from said sending office in the transmission method according to claim 13, and an address of a PCM sound signal and a receiving office and a local station specify as a vertical blanking interval of a video signal.
[Claim 15]A sending set provided with an RF converter which generates a standard television signal.
RF tuner which receives a standard television signal.
Are the transmission method provided with the above and frequency usable to image transmission is detected in a receiving band of said RF tuner in advance of use, It registers with said both transceiving equipment by considering detected frequency as a communication frequency list, and communicates by diffusing a power spectrum by switching frequency within the limits of said communication frequency list.

[Claim 16]A transmission method changing automatically transmission power in the case of said communication in the transmission method according to claim 15 according to operating frequency band width so that power flux density per unit bandwidth may become fixed.
[Claim 17]A transmission method switching frequency in the case of said communication in the transmission method according to claim 15 or 16 synchronizing with synchronous timing of a video signal.
[Claim 18]A transmission method superimposing a control signal on a video signal of a blanking period, and transmitting it in the transmission method according to any one of claims 15 to 17 in the case of said communication.
[Claim 19]A transmission method PCM-izing an audio signal, and superimposing and transmitting on a video signal of a blanking period in the transmission method according to any one of claims 15 to 18 in the case of said communication.
[Claim 20]While the 1st and 2nd transceiving equipment performs a transmission method indicated to either of claims 15 thru/or 19, respectively, While performing a frequency change in single direction to the higher one from the lower one or the lower one from the one where frequency is higher within the limits of said communication frequency list in the case of said communication, When a frequency change order is controlled to return to the beginning of said frequency list when frequency reaches at the end of said frequency list and said 1st and 2nd transceiving equipment uses a frequency timetable which uses always different frequency, A transmission method controlling to communicate by duplex operation.
[Claim 21]While said communication frequency list registered a priori at the time of a start of said

communication is used in the transmission method according to claim 20 and after a communication start uses the 2nd communication frequency list that reproduced said communication frequency list, A transmission method updating said 2nd communication frequency list as required by exchanging communicative quality result information among said 2 sets of transceiving equipment.
[Claim 22]A transmission method making a reference, suiting and registering ID mutually among other transmission equipment which memorizes an identification number (ID is called hereafter) added to transmission equipment at the time of manufacture in a transmission method indicated to either of claims 15 thru/or 21, and permits communication in advance of use.
[Claim 23]In the transmission method according to claim 22, receiving mode is certainly performed before a transmitting mode, A frequency timetable of other transmission equipment of all the under transmission is detected in the same radio wave area, It transmits using a frequency timetable in which using frequency always differs from all the transmission equipment besides these, A transmission method transmitting again using a frequency timetable which is [said frequency time] comparatively different when a sending signal from another device which required communication cannot be detected even if time set beforehand passes after performing a transmitting mode.
[Claim 24]A transmission method characterized by not making original information, including a sound or an image, output when ID which permits communication in receiving mode cannot be checked in the transmission method according to claim 22 or 23.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention connects between apparatus on radio using the electric wave of a weak level, and relates to the transmission equipment and the transmission method for transmitting an image and a sound. Especially the transmission equipment and the transmission method of this invention are related with the thing which enabled it to transmit information between the apparatus left and installed rather than the range of the electric wave of a weak level.
[0002]The transmission equipment and the transmission method of this invention have a standard television broadcasting receiving function of NTSC system, can reduce the influence of a multipass, and are related with the thing which high-definition voice transmission and advanced features are possible, and enabled it to realize a long-distance communication range rather than the case where single frequency is used. The transmission equipment and the transmission method of this invention can realize image transmission by duplex operation, and are related with the thing which enabled it to cancel the influence of a multipass. Furthermore, when use radio wave area uses two or more sets simultaneously in the collective housing etc. with which it may lap indefinitely, the transmission equipment and the transmission method of this invention can cancel interference, and are related with the thing which enabled it to prevent interception.
[0003]
[Description of the Prior Art]In the conventional, for example, the door, television phone etc., transmission of the video signal had the common cable transmission which uses a coaxial line and parallel wires. However, adopting the radio image transmission system which connects between a main phone and cordless handsets on radio using an electric wave from a fitter's ease etc. is examined. Conventionally, standard television broadcasting can be received and the method of choosing one channel from among the unassigned channels of television, and transmitting an image with a feeble radio wave level as a method which can moreover also perform wireless transfer of an image, is examined. This uses the RF converter which generates a standard television signal, and RF tuner which receives a standard television signal.
[0004]As a means different from this, RF tuner is used for broadcast reception and the method of using information-compression extension art together and transmitting the digitized video signal using a small-power-wireless transmitter-receiver is examined by image transmission.
[0005]Here, the video transmission system as an example of the transmission equipment by the above-mentioned conventional feeble radio wave level is shown to drawing 11. The transmitter with which 801 transmits a video signal in drawing 11, the video source in which 809 outputs a

video signal to the transmitter 801, The RF converter which generates a standard television signal 802, the channel switch with which 803 chooses the transmit frequency of RF converter 802, and 804 are the transmission antennas of the transmitter 801. The receiver with which 805 receives a video signal, and 806 The receiving antenna of the receiver 805, The image reproduction circuit which reproduces RF tuner with which 807 receives a standard television signal, and the video signal which restored to 808 with the RF tuner 807, and 810 are indicators which display the image from the receiver 805.

[0006]Next, operation is explained. In the above-mentioned composition, the signalling frequency chosen by RF converter 802 with the channel switch 803 is modulated with the video signal from the video source 809 by the transmitter 801 side. And in the transmitter 801 side, the modulating signal is transmitted via the transmission antenna 804. On the other hand, in the receiver 805 side, the image reproduction circuit 808 reproduces a video signal from the signal which carried out selection reception with the receiving antenna 806 and the RF tuner 807, and an image is displayed by the indicator 810.

[0007]

[Problem(s) to be Solved by the Invention]Since it is the resources in which the electric wave was restricted at such wireless transfer using an electric wave, it is appropriate to use a feeble radio wave at the place where the use ranges in a home etc. were restricted. This feeble radio wave means what does not affect radio equipment, such as a domestic television set. However, there was a problem that range of a feeble radio wave will be short and the distance of the main phone and cordless handset which use a feeble radio weve for this reason will be restricted. This invention was made in order to solve the technical technical problem of the above conventional things, and an object of this invention is to obtain the transmission equipment which can establish a transmission line between the sending offices, such as a main phone and a cordless handset, and the receiving office which were left beyond the range of a feeble radio wave and have been arranged.

[0008]In the above-mentioned conventional transmission equipment, transmission power was a weak level, and since receiving sensitivity was small also in transmission in a short distance, there was a problem that the influence of a multipass was great.

[0009]The weak walkie-talkie which uses the frequency band of standard television broadcasting has a possibility of affecting reception of the existing television broadcasting. More than it, there was a problem that a weak walkie-talkie became unusable in response to the influence from the powerful existing broadcast wave.

[0010]About the method of using compression extension art together and transmitting the video signal which was mentioned above and which used RF tuner for broadcast reception and digitized for image transmission using a small-power-wireless transmitter-receiver. RF tuner, an AD converter, a DA converter, a compression extension processing circuit, a small-power-wireless transmitter, and a small-power-wireless receiver are required, and there was a problem that realization was difficult, from a cost aspect.

[0011]It is what was made in order that this invention might solve the problem of the above conventional things, Even if it transmits information using the frequency band of standard television broadcasting, in response to the existing broadcast wave to influence, it does not become unusable, and realization aims at acquiring easy transmission equipment and transmission method also in respect of cost.

[0012]

[Means for Solving the Problem]In order to solve said technical problem, the invention of this invention according to claim 1, The sending office which transmits an image or a sound using a feeble radio wave, and a receiving office which transmits an image or a sound using a feeble radio wave, Have a relay station arranged between said sending office and a receiving office which have been arranged exceeding range of said feeble radio wave, and from said sending office to a sending signal. Including information which shows an address of a receiving office in addition to original information, including an image, a sound, etc., and information which shows frequency which a local station receives from a relay station, said relay station, While becoming irregular and outputting to different frequency from frequency of a feeble radio wave which received from said sending office, from the receiving office side, add information on frequency which a local station receives, transmit, and said receiving office, Recognition of that it is a signal

addressed to a local station will establish a transmission line of the sending office and a receiving office by modulating a feeble radio wave in frequency which said relay station specified, and transmitting an image and a sound to it.According to this invention, when transmitting an image and a sound using a feeble radio wave, transmission in case distance of the sending office and a receiving office exceeds range of a feeble radio wave is enabled.

[0013]In the transmission equipment according to claim 1, the invention of this invention according to claim 2 to a sending signal of an outward trip turned to said receiving office from said sending office. A standard television signal was used and information which shows received frequency which an address of a PCM sound signal and a receiving office and a local station specify as a vertical blanking interval of a video signal was superimposed. According to this invention, when transmitting an image and a sound using a feeble radio wave, transmission in case distance of the sending office and a receiving office exceeds range of a feeble radio wave is enabled.

[0014]The invention of this invention according to claim 3 is characterized by comprising:

A sending set provided with an RF converter which generates a standard television signal.

A receiving set provided with RF tuner which receives a standard television signal.

An usable frequency detection means which detects frequency usable to image transmission in a receiving band of said RF tuner in advance of use.

A detection frequency registration means to register with said both transceiving equipment by considering detected frequency as a communication frequency list, and a spread spectrum communication means which communicates by diffusing a power spectrum by switching frequency within the limits of said communication frequency list.

While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission and advanced features are possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, a video transmission system which can live together can be provided.

[0015]In the transmission equipment according to claim 3, the invention of this invention according to claim 4 is provided with a transmission-power-control means to change automatically transmission power in the case of said communication according to operating frequency band width so that power flux density per unit bandwidth may become fixed. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission and advanced features are possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, a video transmission system which can live together can be provided.

[0016]The invention of this invention according to claim 5 is provided with a frequency switching means which switches frequency in the case of said communication synchronizing with synchronous timing of a video signal in the transmission equipment according to claim 3 or 4. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission and advanced features are possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, a video transmission system which can live together can be provided.

[0017]The invention of this invention according to claim 6 is provided with a control signal superposition transmission means which superimposes a control signal on a video signal of a blanking period, and transmits it in the case of said communication in the transmission equipment according to any one of claims 3 to 5. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass can be reduced and it can have advanced features, and even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, a video transmission system which can live together can be provided.

[0018]In the transmission equipment according to any one of claims 3 to 6, in the case of said communication, the invention of this invention according to claim 7 PCM-izes an audio signal, and is provided with an audio signal superposition transmission means superimposed and transmitted on a video signal of a blanking period. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission is possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, a video transmission system which can live together can be provided.
[0019]The invention of this invention according to claim 8 is characterized by comprising:
The 1st and 2nd transceiving equipment that consists of transmission equipment indicated to either of claims 3 thru/or 7, respectively.
While performing a frequency change in single direction to the higher one from the lower one or the lower one from the one where frequency is higher within the limits of said communication frequency list in the case of said communication, A frequency change sequence control means to control a frequency change order to return to the beginning of said frequency list when frequency reaches at the end of said frequency list.
A communication control means which controls so that said 1st and 2nd transceiving equipment communicates by duplex operation by using a frequency timetable which uses always different frequency.
According to this invention, while realizing image transmission by duplex operation, a video transmission system which canceled influence of a multipass can be provided.
[0020]In the transmission equipment according to claim 8 the invention of this invention according to claim 9, While said communication frequency list registered a priori at the time of a start of said communication is used and after a communication start uses the 2nd communication frequency list that reproduced said communication frequency list, It has a communication frequency list update means which updates said 2nd communication frequency list as required by exchanging communicative quality result information among said 2 sets of transceiving equipment. According to this invention, while realizing image transmission by duplex operation, a video transmission system which canceled influence of a multipass can be provided.
[0021]The invention of this invention according to claim 10 is characterized by that transmission equipment indicated to either of claims 3 thru/or 9 comprises:
An ID storage means which memorizes an identification number (ID is called hereafter) added to transmission equipment at the time of manufacture.
An ID reference registration means to make a reference, to suit and to register ID mutually among other transmission equipment which permits communication in advance of use.
According to this invention, a video transmission system which use radio wave area cancels interference in collective housing with which it may lap indefinitely, and prevents interception can be provided.
[0022]The invention of this invention according to claim 11 is characterized by that the transmission equipment according to claim 10 comprises:
A frequency setting means which transmits using a frequency timetable in which receiving mode is certainly performed before a transmitting mode, a frequency timetable of other transmission equipment of all the under transmission is detected in the same radio wave area, and using frequency always differs from all the transmission equipment besides these.
A retransmission means which transmits again using a frequency timetable which is [said frequency time] comparatively different when a sending signal from another device which required communication cannot be detected even if time set beforehand passes after performing a transmitting mode.
According to this invention, a video transmission system which use radio wave area cancels interference in collective housing with which it may lap indefinitely, and prevents interception can be provided.
[0023]In the transmission equipment according to claim 10 or 11, by receiving mode, the invention of this invention according to claim 12 is provided with an output halt means to which original information, including a sound or an image, is not made to output, when ID which permits communication cannot be checked. According to this invention, a video transmission system

which use radio wave area cancels interference in collective housing with which it may lap indefinitely, and prevents interception can be provided.
[0024]The invention of this invention according to claim 13 is a transmission method for transmitting an image or a sound mutually between the sending office and a receiving office using a feeble radio wave, Arrange a relay station between said sending office and a receiving office which have been arranged exceeding range of said feeble radio wave, and from said sending office to a sending signal. Including information which shows an address of a receiving office in addition to original information, including an image, a sound, etc., and information which shows frequency which a local station receives from a relay station, said relay station, While becoming irregular and outputting to different frequency from frequency of a feeble radio wave which received from said sending office, from the receiving office side, add information on frequency which a local station receives, transmit, and said receiving office, Recognition of that it is a signal addressed to a local station will establish a transmission line of the sending office and a receiving office by modulating a feeble radio wave in frequency which said relay station specified, and transmitting an image and a sound to it. According to this invention, when transmitting an image and a sound using a feeble radio wave, transmission in case distance of the sending office and a receiving office exceeds range of a feeble radio wave is enabled.
[0025]In the transmission method according to claim 13, the invention of this invention according to claim 14 to a sending signal of an outward trip turned to said receiving office from said sending office. A standard television signal is used and information which shows received frequency which an address of a PCM sound signal and a receiving office and a local station specify as a vertical blanking interval of a video signal is superimposed. According to this invention, when transmitting an image and a sound using a feeble radio wave, transmission in case distance of the sending office and a receiving office exceeds range of a feeble radio wave is enabled.
[0026]A sending set with which the invention of this invention according to claim 15 was provided with an RF converter which generates a standard television signal, It is the method of transmitting between receiving sets provided with RF tuner which receives a standard television signal, In advance of use, frequency usable to image transmission is detected in a receiving band of said RF tuner, It registers with said both transceiving equipment by considering detected frequency as a communication frequency list, and communicates by diffusing a power spectrum by switching frequency within the limits of said communication frequency list. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission and advanced features are possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, an image transmission method which can live together can be provided.
[0027]In the transmission method according to claim 15, the invention of this invention according to claim 16 changes automatically transmission power in the case of said communication according to operating frequency band width so that power flux density per unit bandwidth may become fixed. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission and advanced features are possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, an image transmission method which can live together can be provided.
[0028]The invention of this invention according to claim 17 switches frequency in the case of said communication in the transmission method according to claim 15 or 16 synchronizing with synchronous timing of a video signal. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission and advanced features are possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, an image transmission method which can live together can be provided.
[0029]In the transmission method according to any one of claims 15 to 17, in the case of said communication, the invention of this invention according to claim 18 superimposes a control

signal on a video signal of a blanking period, and transmits it. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass can be reduced and it can have advanced features, and even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, an image transmission method which can live together can be provided.
[0030]In the transmission method according to any one of claims 15 to 18, in the case of said communication, the invention of this invention according to claim 19 PCM-izes an audio signal, and superimposes and transmits it on a video signal of a blanking period. While having a standard television broadcasting receiving function of NTSC system according to this invention, Influence of a multipass is reduced, and even if high-definition voice transmission is possible, a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than a case where single frequency is used in the future, an image transmission method which can live together can be provided.
[0031]While performing a transmission method indicated to either of claims 15 thru/or 19, the invention of this invention according to claim 20 the 1st and 2nd transceiving equipment, respectively, While performing a frequency change in single direction to the higher one from the lower one or the lower one from the one where frequency is higher within the limits of said communication frequency list in the case of said communication, When a frequency change order is controlled to return to the beginning of said frequency list when frequency reaches at the end of said frequency list and said 1st and 2nd transceiving equipment uses a frequency timetable which uses always different frequency, It controls to communicate by duplex operation. According to this invention, while realizing image transmission by duplex operation, an image transmission method which canceled influence of a multipass can be provided.
[0032]In the transmission method according to claim 20 the invention of this invention according to claim 21, While said communication frequency list registered a priori at the time of a start of said communication is used and after a communication start uses the 2nd communication frequency list that reproduced said communication frequency list, Said 2nd communication frequency list is updated as required by exchanging communicative quality result information among said 2 sets of transceiving equipment. According to this invention, while realizing image transmission by duplex operation, a video transmission system which canceled influence of a multipass can be provided.
[0033]In a transmission method with which the invention of this invention according to claim 22 was indicated to either of claims 15 thru/or 21, An identification number (ID is called hereafter) added to transmission equipment at the time of manufacture is memorized, among other transmission equipment which permits communication in advance of use, mutually, a reference is made, it suits and ID is registered. According to this invention, an image transmission method which use radio wave area cancels interference in collective housing with which it may lap indefinitely, and prevents interception can be provided.
[0034]In the transmission method according to claim 22 the invention of this invention according to claim 23, Certainly perform receiving mode before a transmitting mode, and a frequency timetable of other transmission equipment of all the under transmission is detected in the same radio wave area, It transmits using a frequency timetable in which using frequency always differs from all the transmission equipment besides these, When a sending signal from another device which required communication cannot be detected even if time set beforehand passes after performing a transmitting mode, it transmits again using a frequency timetable which is [said frequency time] comparatively different. According to this invention, an image transmission method which use radio wave area cancels interference in collective housing with which it may lap indefinitely, and prevents interception can be provided.
[0035]The invention of this invention according to claim 24 does not make original information, including a sound or an image, output by receiving mode in the transmission method according to claim 22 or 23, when ID which permits communication cannot be checked. According to this invention, an image transmission method which use radio wave area cancels interference in collective housing with which it may lap indefinitely, and prevents interception can be provided.
[0036]
[Embodiment of the Invention](Embodiment 1) This Embodiment 1 establishes the transmission

line by a feeble radio wave by arranging the relay station from which transmission of a video signal or an audio signal is relayed between the sending offices, such as a main phone and a cordless handset, and the receiving office which were left beyond the range of a feeble radio wave and have been arranged. This Embodiment 1 corresponds to the invention indicated to claims 1 and 2 and claims 13 and 14 of this application.

[0037]Below, the embodiment of the invention 1 is described with reference to drawings. Here, a door television phone is mentioned as an example and explained. That is, this transmission equipment transmits a visitor's image and sound which were photographed with the cordless handset of the door to an indoor main phone, from a main phone, transmits only a sound and performs a mutual telephone call.

[0038]Drawing 1 (a) is a lineblock diagram of the transmission equipment in the embodiment of the invention 1. Drawing 1 (b) is a block diagram explaining the circuitry of each office in the transmission equipment. In drawing 1 (a), the sending office as a cordless handset which arranges 1 in the door, and 4 are the terminals connected to the sending office 1, and have the microphone and loudspeaker for conversation with the camera for incorporating a visitor's image, and an indoor resident. 2 is a relay station, and in order to arrange in a passage etc., it does not have the terminal for outputting and inputting an image and a sound. The receiving office as a main phone which arranges 3 indoors, and 5 are the terminals connected to the receiving office 3, and have a microphone, a loudspeaker, etc. for the monitor which projects a visitor, and the conversation of a visitor and an indoor resident.

[0039]6 shows the range of access of the feeble radio wave of the sending office 1, and arranges the relay station 2 to within the circle [this]. 7 shows the range of access of the feeble radio wave which the relay station 2 outputs, and arranges the sending office 1 and the receiving office 3 to within the circle [this]. 8 shows the range of access of the feeble radio wave which a receiving office outputs, and arranges the relay station 2 to within the circle [this].

[0040]Next, operation is explained. Each offices 1, 2, and 3 transmit and receive on mutually different frequency. That is, the sending office 1 transmits the signal which calls the receiving office 3 from the terminal 4 on the frequency f1. At this time, the sending office 1 specifies that the frequency which a local station receives is f0. The relay station 2 modulates and outputs the signal of the call which received to the different frequency f2 from this. At this time, the relay station 2 adds and outputs the information on the purport that the frequency which a local station receives is f1. The receiving office 3 receives the call signal of the frequency f2, and outputs it to the terminal 5. And the receiving office 3 outputs the signal of the response from the terminal 5 on the frequency f1 which the relay station 2 specifies. If the relay station 2 receives the reply signal of the received frequency which a local station specifies, this is modulated and outputted to the frequency which the sending office 1 specifies, it will be that the sending office 1 receives this, and a transmission line will be established.

[0041]An example of the modulating signal transmitted to the receiving office 3 as a main phone from the sendlng office 1 side as a cordless handset is shown in drawing 3. This superimposes PCM sound signal 303 and the system control signals 304 on the horizontal scanning period 302 in the vertical blanking interval 301 of the odd number field of the video signal used on standard television. The speech information from the terminal 4 of the sending office 1 is included in PCM sound signal 303. The destination information which shows that the office 3 provided with the terminal 5 is a mail arrival place, the information on the frequency which a local station receives, etc. are included in the system control signals 304.

[0042]Drawing 1 (b) shows the block diagram of the circuit of each office. The main part 1101 of each office is provided with the following.

The channel selection and video voice demodulator circuit 1102 for specifying the frequency which a local station receives, while restoring to the image or audio signal received from the other station.

The high frequency image modulation circuit 1103 which modulates the video signal which an audio signal and system control signals superimposed.

The high frequency noise voice modulation circuit 1104 which modulates an audio signal.

The control circuit 1105 for controlling the change of the frequency of these each circuit, or performing an exchange of a video signal, an audio signal, and a manipulate signal etc. between the main part 1101 of each office, and the terminal 1107 connected to this, and the transmitting

antennas 1106.
Although 1107 is a terminal which sends the manipulate signal for operation of a video signal, an audio signal, and apparatus towards each office main part 1101, or receives the video signal from each office main part 1101, an audio signal, and a manipulate signal conversely, it is not installed in the relay station 2 as mentioned above.
[0043]Hereafter, signs that a transmission line extends one by one and it is established using drawing 2 are explained concretely. First, in the stage where the sending office 1 is not discharging the electric wave, each office is operating the channel selection and video voice demodulator circuit 1102. And it is monitoring, scanning whether the electric wave from an other station is discharged in the inside of the frequency range decided beforehand. And it is being supervised whether the sending office 1 has simultaneously a send request from the terminal 4 connected to this.
[0044]And as the 1st step shown in drawing 2 (a), if the video voice signal and send request from the terminal 4 are inputted into the sending office 1, the sending office 1 will transmit the high frequency signal of the frequency f1 modulated with the modulating signal shown in drawing 3. As mentioned above, the information which shows the receiving office 3, and the information whose received frequency of a local station is f0 are added to this signal (superposition). Based on the result of having performed the frequency monitor, other radio equipment does not use it and the frequency of this f1 and f0 chooses frequency with few noises beforehand until it receives a send request.
[0045]The reason for overlapping and transmitting to a video signal by making speech information from the terminal 4 into a PCM sound signal is for using in usual the frequency for the voice transmission used on standard television as return trip transmission of the relay station 2. For this reason, in an outward trip, the frequency for this voice transmission transmits with no becoming irregular. Since the relay station 2 which was, on the other hand, monitoring whether the electric wave would be discharged from the other station is in the electric wave range of the sending office 1, it receives the transmit radio wave of the frequency f1 from this sending office 1. At this time, since the receiving office 3 is not in the electric wave range from the sending office 1, reception is impossible.
[0046]Next, as the 2nd step shown in drawing 2 (b), the relay station 2 gets to know that a mail arrival address is not a local station, as a result of restoring to a reception radio wave. Then, the information that the frequency which a local station receives is f1 is added, and it is considered as a modulating signal, and becomes irregular and transmits to the system control signals on the video signal to which it restored on the frequency of f2. This transmit frequency f2 is chosen based on the result of having monitored frequency a priori.
[0047]In addition, in the relay station 2, it knows that it will receive on the frequency of the sending office one f0, and this frequency of f0 must be used in a return trip. Then, the relay station 2 modulates and transmits the voice demodulation signal acquired by receiving to the frequency of f0 as it is, and establishes a return trip. Since the receiving office 3 which was, on the other hand, monitoring whether the electric wave would be discharged from the other station is in the range of the electric wave from the relay station 2, it receives the transmit radio wave of f2 from the relay station 2.
[0048]As the third step shown in drawing 2 (c), as a result of restoring to a reception radio wave, an address gets to know that it is the terminal 5 which leads to a local station in the receiving office 3. Then, while recovering a sound from the PCM sound signal on the received video signal, the manipulate signal of the terminal 5 is extracted from system control signals, it separates from a video signal, and these manipulate signals, a video signal, and an audio signal are outputted to the terminal 5.
[0049]In the receiving office 3, it is a receive state on the frequency of the relay station two f1, and knows that the frequency of f1 must be used as a return trip. Then, the reply signal that image transmission was performed normally is modulated to the sound outside an auditory sensation area, and it becomes irregular and transmits to the frequency of f1 by making into a modulating signal what superimposed the audio signal from the terminal 5 on this correspondence-auditory sensation area outside item.
[0050]Since the relay station 2 which received the electric wave of the frequency f1 has already established the return trip on the frequency of f0, it can transmit immediately the reply signal and

audio signal from the receiving office 3 to the sending office 1 on the frequency of f0. And while the sending office 1 can continue monitoring that image transmission is normally working from a reply signal by separating a reply signal and an audio signal out of the reception radio wave from this relay station 2, Since the sound from the terminal 5 is receivable, audio bidirectional transmission becomes possible.

[0051]Thus, according to this Embodiment 1, to the signal transmitted from the sending office. Besides an image or a sound, including the information which shows an address for for [which] receiving offices it is, and the information which shows the frequency which a local station receives from a relay station, a relay station, Modulate and output the signal from the sending office side to different frequency from the received frequency, and at this time a relay station, From the receiving office side, the information which shows the frequency which a local station receives is added, and it transmits, and a receiving office will be modulated and transmitted to the frequency as which the relay station specified the image or the audio signal, if it recognizes that it is a signal addressed to a local station. Even if the distance of the sending office 1 by the side of a cordless handset and the receiving office 3 by the side of a main phone is the distance exceeding the range of a feeble radio wave, the transmission line of the sending office and a receiving office is establishable because a relay station transmits this signal to the sending office side one by one. And transmission of a full duplex is attained [image] about half duplex and a sound, and transmission of the control signal of a system is attained.

[0052]According to this Embodiment 1, although the relay station was constituted only from one, if a relay station is increased, and it arranges in order and goes for every range of access of a feeble radio wave, distance of the sending office and a receiving office can be lengthened further. Although the example of transmission of one way from the cordless handset side to the main phone side was shown about the video signal, If the using frequency of a high frequency image modulation circuit and the using frequency of a high frequency noise voice modulation circuit are replaced, since an outward trip and a return trip will be reversed, it becomes seemingly possible by replacing using frequency at high speed to perform bidirectional simultaneous transmission of an image.

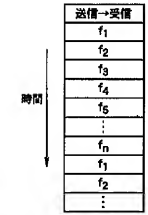
[0053]Although the above-mentioned Embodiment 1 showed the example which does not provide a terminal in a relay station, if a terminal is added also to a relay station at the same time it increases a relay station, it is not fixed but the sending office and the receiving office can establish a transmission line in arbitrary offices. Although the door television phone was mentioned as the example and this Embodiment 1 explained the terminal, it becomes possible not only this but to apply to a video camera, VTR, a portable TV phone, etc. as a terminal. Although this Embodiment 1 showed the case where the digitized audio signalwas [PCM-] made to beized, it is also possible to use other compression encoding systems.

[0054](Embodiment 2) This Embodiment 2 can transmit information by performing frequency diffusion communication, without being influenced by a multipass, even if it uses a feeble radio wave. Hereafter, the embodiment of the invention 2 is described using drawing 4, drawing 6, drawing 7, drawing 8, drawing 9, and Table 1. This Embodiment 2 corresponds to the invention indicated to claim 3 thru/or claim 7 and claim 15 thru/or claim 19 of this application.

[0055]Drawing 4 shows the composition of the transmission equipment by the embodiment of the invention 2. Drawing 6 shows the signal power of the embodiment of the invention 2. Drawing 7 shows the receiving level of the embodiment of the invention 2. Drawing 8 shows the transmission state of the image of the embodiment of the invention 2 by comparison with a conventional example. Drawing 9 shows the video signal of the embodiment of the invention 2. Table 1 shows a frequency change order of the embodiment of the invention 2.

[0056]

[Table 1]



The sending set with which 101 transmits in drawing 4, the transmission antenna with which 115 transmits an electric wave, The RF converter with which 102 generates a standard television signal, the voltage controlled oscillator which oscillates 111 on the frequency according to control voltage, The composing device which compounds because 112 adds two input signals, the mixer which compounds because 113 carries out the multiplication of the two inputs, The variable attenuator in which 114 decreases an input according to a control signal, the communication terminal in which 103 receives the input from the outside, An audio input terminal for an external instrument contact button for 104 to connect an external instrument and 105 to input an audio signal, A video input terminal for 106 to input a video signal, the AD converter from which 109 changes an analog signal into a digital signal, A comparator [input signal / preset value / 110], the control circuit for which 107 controls this sending set 101, the store circuit which 108 uses for the control circuit 107 memorizing information, and 116 are the registering buttons for registering setting out of this sending set 101.

[0057]The receiving set with which 117 receives, the receiving antenna with which 132 receives an electric wave, RF tuner with which 118 receives a standard television signal, the voltage controlled oscillator which oscillates 128 on the frequency according to control voltage, The mixer which compounds because 129 carries out the multiplication of the two inputs, the AGC circuit where 130 adjusts the profit of a signal automatically, The intermediate frequency processing circuit where 131 processes an intermediate frequency signal, the control circuit where 123 controls this receiving set 117, The store circuit which uses 124 for the control circuit 123 memorizing information, the DA converter for which 125 changes a digital signal into an analog signal, A comparator [input signal / preset value / 126], the voice changeover switch with which 127 outputs either of two audio signals, A detection button for 133 to direct detection of the existence of transmission to this receiving set 117, An image output terminal for an external instrument contact button for a communication terminal for 119 to output a signal outside and 120 to connect an external instrument and 121 to output a video signal and 122 are the audio output terminals for outputting an audio signal.

[0058]500 is the usable frequency detection means indicated to claim 3. This usable frequency detection means 500 detects frequency usable to image transmission in the receiving band of RF tuner in advance of use, and comprises the RF tuner 118, the control circuit 123, the store circuit 124, the comparator 126, and the detection button 133.

[0059]501 is the frequency registration means indicated to claim 3. This frequency registration means 501 is registered into both transceiving equipment by considering frequency detected and detected as a communication frequency list, and comprises the communication terminal 103,119, the control circuit 107,123, the store circuit 108,124, and the registering button 116.

[0060]502 is the spread spectrum communication means indicated to claim 3. By switching frequency at high speed within the limits of a communication frequency list, this spread spectrum communication means 502 diffuses a power spectrum, communicates, and comprises the control circuit 107,123, the store circuit 108,124, RF converter 102, and the RF tuner 118.

[0061]503 is the transmission-power-control means indicated to claim 4. This transmission-power-control means 503 changes transmission power automatically according to operating

frequency band width so that the power flux density per unit bandwidth may become fixed, and it comprises the control circuit 107, the store circuit 108, and the variable attenuator 114.
[0062]504 is the frequency switching means indicated to claim 5. This frequency switching means 504 switches frequency by the synchronous timing of a video signal, and comprises the video input terminal 106, the comparator 110,126, and the control circuit 107,123.
[0063]505 is the control signal superposition transmission means indicated to claim 6. This control signal superposition transmission means 505 superimposes a control signal on the video signal of a blanking period, transmits it, and comprises the external instrument contact button 104,120, the control circuit 107,123, the comparator 110,126, and the composing device 112.
[0064]506 is the audio signal superposition transmission means indicated to claim 7. This audio signal superposition transmission means 506 is what PCM-izes an audio signal, and is superimposed and transmitted on the video signal of a blanking period, It comprises the audio input terminal 105, the audio output terminal 122, AD converter 109, DA converter 125, the control circuit 107,123, the comparator 110,126, the composing device 112, and the voice change-over switch 127.
[0065]Here, frequency usable to image transmission is the frequency band shown with the numerals 307 in drawing 6. There is no broadcast wave 305 in the frequency 307 usable to this image transmission, and there is also no image reception 306 of an extraneous noise or a strong broadcast wave in it further.
[0066]Next, operation is explained. In drawing 4, if the detection button 133 of the receiving set 117 is pushed by the operator, the control circuit 123 will start operation. The control circuit 123 controls the RF tuner 118 to receive all the frequency in the receiving band 303 briefly. The video output of the RF tuner 118 is inputted into the comparator 126. It is compared with a predetermined detection value. The comparison result is inputted into the control circuit 123. Based on the comparison result, the control circuit 123 detects frequency usable to image transmission, and memorizes frequency without the video synchronizing signal by the broadcast wave and the image wave of a broadcast wave, and the random signal by an extraneous noise as a list to the store circuit 124.
[0067]If the registering button 116 of the sending set 101 is pushed by the operator once between the sending set 101 and the receiving set 117 is connected by a cable via the communication terminal 103,119 in advance of use, The control circuit 107 of the sending set 101 requires the list of usable frequency of image transmission from the control circuit 123 of the receiving set 117 via the communication terminal 103.
[0068]The control circuit 123 of the receiving set 117 is sent out also to the sending set 101 via the communication terminal 119,103 while it reads the list of usable frequency to image transmission memorized in the store circuit 124 and memorizes it to this store circuit 124 again as a communication frequency list. In the sending set 101, it memorizes to the store circuit 108 by considering the list of frequency usable to image transmission sent from the receiving set 117 as a communication frequency list.
[0069]If the image transmission request signal from an external instrument is inputted into the external instrument control terminal 104 of the sending set 101 and the video signal from an external instrument is further inputted into the video input terminal 106 in drawing 4, The control circuit 107 of the sending set 101 reads the communication frequency list memorized in the store circuit 108. And after setting the magnitude of attenuation of the variable attenuator 114 as the maximum in parallel to this, RF converter 102 is operated.
[0070]By a frequency change order which shows within the limits of the read communication frequency list, for example in Table 1, after the control circuit 107 diffuses a power spectrum by switching RF frequency of RF converter 102 at high speed, it makes small the magnitude of attenuation of the variable attenuator 114, and starts transmission. A change order of the frequency of Table 1 shows an example of what it has decided on beforehand with the sending set 101 and the receiving set 117.
[0071]Communication frequency is switched according to the timing of the Horizontal Synchronizing signal of a video signal, or a Vertical Synchronizing signal inputted from the video input terminal 106. In that case, the synchronized signal to be used is extracted from a video signal by the comparator 110.
[0072]Here, in order to prevent the influence of the radio equipment on others and to aim at

effective use of an electric wave, it is necessary to use RF power density per unit bandwidth transmitted from the sending set 101 as 304 or less feeble radio wave level shown in drawing 6. Therefore, the control circuit 107 asks for the bandwidth of using frequency, and the dispersion ratio of a power spectrum from a communication frequency list, and it adjusts the magnitude of attenuation of the variable attenuator 114 so that RF power density per unit bandwidth may be made regularity by this.

[0073]On the other hand, in drawing 4, if the request signal of image reception is inputted into the external instrument control terminal 120 of the receiving set 117 from an external instrument, the control circuit 123 of the receiving set 117 will operate the RF tuner 118 while reading the communication frequency list memorized in the store circuit 124.

[0074]Thereby, the control circuit 123 switches the received frequency of the RF tuner 118 at high speed, and receives the RF signal from the sending set 101. The change performs this so that it may become a change order of frequency which shows within the limits of the communication frequency list which the control circuit 123 read in Table 1. The switching timing of frequency changes using the pseudo synchronization timing generated in control circuit 123 inside.

[0075]Here, reception is started with the receiving set 117 and the synchronous timing of the video signal of the transmitting side and the pseudo synchronization timing of a receiver are not necessarily in agreement during the ****. Since transmit frequency and received frequency furthermore are not necessarily in agreement in time, either, the signal has not appeared in the video output of the RF tuner 118 of the receiving set 117, and the output of the comparator 126. Therefore, monitoring the output of the comparator 126, the control circuit 123 of the receiving set 117 changes the timetable start time of pseudo synchronization timing and received frequency one by one, and tries detection of a sending signal. Here, since the timetable cycle of the synchronous timing of the video signal of the transmitting side and transmit frequency is constant, it succeeds in detection of a sending signal after fixed trial in a receiver. If it succeeds in detection of a sending signal, the control circuit 123 of the receiving set 117 will use the synchronous timing of the received video signal extracted by the comparator 126 for pseudo synchronization timing, changing it.

[0076]Generally, the receiving level of the wireless transfer which uses a wide band is influenced by the frequency characteristic of a multipass or transmitting antennas. When influenced by the frequency characteristic of a multipass or transmitting antennas, a receiving level changes a lot like the characteristic 406 shown in drawing 7. And a receiving level cannot reproduce a video signal in the frequency used as 407 or less communication marginal level. Therefore, in the conventional method which uses single frequency, when the position of ** and a receiving set changed while in use, or when the position of the circumference reflecting object which reflects an electric wave changed, as shown in drawing 8 (a), the condition it becomes impossible to completely receive an electric wave occurred, and the using feeling was falling remarkably. On the other hand, in the embodiment of the invention 2, since it becomes impossible to only reproduce a part of video signal as shown in drawing 8 (b), a receive state is improved.

[0077]Here, in order to prevent the influence of the radio equipment on others and to aim at effective use of an electric wave generally, the maximum of the field intensity in the point from which the wireless transmission device which uses a feeble radio wave separated only constant distance is restricted. Although the maximum is determined according to the stage of influence on other radio equipment which uses the same existing frequency band, the inspecting measurement method is determined as a standard in the method of the near radio equipment which may be influenced. Control of the field intensity in the point which only constant distance left is realizable by controlling transmission power by the case where a fixed transmission antenna is used for apparatus.

[0078]Although the interaction of the radio equipment of the method which uses single frequency, and the radio equipment of the method which diffuses and uses a spectrum is great, there is a method that the interaction between both methods is small. This situation is applied even if it attaches without the transmission equipment of this invention which diffuses a use spectrum and transmits the frequency band of standard television broadcasting, and other existing radio equipment, i.e., the television set which uses single frequency.

[0079]Compared with the method which uses the frequency band of standard television broadcasting and uses the conventional single frequency from the above reason with the

transmission equipment of this embodiment which diffuses a spectrum and transmits, transmission by bigger output power is possible. In connection with this, since received power also increases, transmission distance can also be lengthened.
[0080]In the transmission equipment of this embodiment, usable frequency is used for image transmission in advance of use, carrying out detection registration. For this reason, even if digital television broadcasting and mobile communications equipment will come to use the zone in the future, coexistence with these systems is possible.
[0081]In the state where the video signal is transmitted from the sending set 101 here, When the control signal which operates the external instrument connected to the receiving set 117 is inputted into the external instrument contact button 104 of the sending set 101, the control circuit 107 of the sending set 101, To the timing superimposed on the video signal of the blanking period shown in drawing 9, the received control signal is outputted to RF converter 102. By the composing device 112 in RF converter 102, a control signal is superimposed by the portion of the data 605 of drawing 9, and is transmitted towards the receiving set 117.
[0082]In the receiving set 117 which received the video signal on which it was superimposed, a control signal extracts a control signal from a video signal with the comparator 126, and outputs to the external instrument contact button 120. This becomes possible to operate the external instrument connected to the receiving set 117 from the external instrument connected to the sending set 101, and a highly efficient video transmission system is realized.
[0083]If an audio signal is inputted into the audio input terminal 105 in the state where the video signal is transmitted, from the sending set 101, the audio signal by which the AD translation was carried out by AD converter 109 of the sending set 101 will be inputted into the control circuit 107. If the audio signal by which the AD translation was carried out is inputted, the control circuit 107 PCM-izes the received audio signal further, will be the timing superimposed on the video signal of the blanking period shown in drawing 9, and will output this PCM signal to RF converter 102. By the composing device 112 in RF converter 102, a PCM signal is superimposed by the portion of the data 605 of drawing 9, and is transmitted towards the receiving set 117.
[0084]In the receiving set 117 which received the video signal on which it was superimposed, a PCM signal extracts a PCM signal from a video signal with the comparator 126, and outputs to the control circuit 123. The control circuit 123 switches the voice switch circuit 127 to PCM voice condition of use while outputting a PCM signal to DA converter 125. In DA converter 125, a PCM signal is changed into an audio signal and it outputs to the audio output terminal 122. Thereby, high-definition voice transmission without the voice noise accompanying the change of communication frequency is realized.
[0085]Thus, the transmission equipment by this Embodiment 2, In advance of use, frequency usable to image transmission is detected in the receiving band of RF tuner in a receiving set, Since it registers with the both sides of said sending set and a receiving set by considering detected frequency as a communication frequency list, a power spectrum is diffused by switching frequency at high speed within the limits of said communication frequency list and it was made to communicate, Image transmission to the cheap simplex which also has a receiving function of television broadcasting, i.e., one way, is realizable. The influence of a multipass can be reduced and it is not influenced by the powerful existing broadcast wave, either. And a communication range longer than the method which uses single frequency can be attained, and even if future digital television broadcasting and mobile communications use the zone, the video transmission system which can live together is realizable.
[0086]He is trying to change transmission power automatically according to operating frequency band width so that the power flux density per unit bandwidth may become fixed, The video transmission system which operates with the weak radio wave level which always does not do reception interference to the existing radio receiving device even if operating frequency band width changes is realizable. It enables it to switch frequency by the synchronous timing of a video signal, disorder of the video signal accompanying the change of frequency can be reduced, and the video transmission system of good image quality can be realized.
[0087]Since a control signal is superimposed on the video signal of a blanking period and was transmitted, a controllable highly efficient video transmission system is [operation of a receiving set] realizable from a sending set. Since an audio signal is PCM-ized, and it superimposes on the video signal of a blanking period and was made to transmit, the noise of the audio signal

accompanying the change of frequency can be abolished, and the video transmission system of good tone quality can be realized.

[0088]Therefore, while having a standard television broadcasting receiving function of NTSC system, the influence of a multipass is reduced, high-definition voice transmission and advanced features are possible, and a long-distance communication range can be realized rather than the case where single frequency is used. It is able for a camera to apply to a dismountable VTR movie device etc. by wireless from the Records Department main part for it to be able to live together, even if digital television broadcasting and mobile communications equipment will come to use the zone in the future.

[0089]Although this Embodiment 2 showed the case where the digitized audio signalwas [PCM-] made to beized, it is also possible to use other compression encoding systems. Although this Embodiment 2 showed the case where NTSC system was used as a standard television signal, it is also possible to use a PAL system and an SECAM system.

[0090](Embodiment 3) This Embodiment 3 forms two transceiving equipment having the sending set and receiving set of Embodiment 2. Hereafter, the embodiment of the invention 3 is described using drawing 5, drawing 6, drawing 7, drawing 8, drawing 9, and Table 2. This Embodiment 3 supports the invention indicated to claims 8 and 9 and claims 20 and 21 of this application.

[0091]Drawing 5 shows the composition of the transmission equipment by the embodiment of the invention 3. Drawing 6 shows the signal power in the embodiment of the invention 3. Drawing 7 shows the receiving level of the embodiment of the invention 3. Drawing 8 shows the transmission state of the image of the embodiment of the invention 3 by comparison with a conventional example. Drawing 9 shows the video signal of the embodiment of the invention 3. Table 2 shows a frequency change order and frequency timetable of the embodiment of the invention 3.

[0092]

[Table 2]

第1→第2	第2→第1
f_1	f_{n-1}
f_2	f_n
f_3	f_1
f_4	f_2
f_5	f_3
⋮	⋮
f_n	f_{n-2}
f_1	f_{n-1}
f_2	f_n
⋮	⋮

時間 ↓

The transceiving equipment with which 201A and 201B transmit and receive in a figure, the RF converter with which 202A and 202B generate a standard television signal, The voltage controlled oscillator which oscillates 215A and 215B on the frequency according to control voltage, The composing device compounded because 216A and 216B add two input signals, The mixer compounded because 217A and 217B carry out the multiplication of the two input signals, The variable attenuator in which 218A and 218B compound an input signal according to a control signal, A communication terminal for the transmitting antennas with which 219A and 219B transmit and receive an electric wave, and 207A and 207B to output a signal for the input from the outside to the receptacle exterior, An external instrument contact button for 208A and 208B to connect an external instrument, A video input terminal for an audio input terminal for 205A and 205B to input an audio signal, and 204A and 204B to input a video signal, The AD converter from which 213A and 213B change an analog signal into a digital signal, A comparator [input signal / preset value /B / 214A and / 214], the control circuit for which 211A and 211B control this transceiving equipment 201A and 201B, the store circuit which 212A and 212B use for the control circuits 211A and 211B memorizing information, 206A and 206B register setting out of this transceiving equipment 201A and 201B, or, The detection registering button for directing

detection of the existence of transmission to this transceiving equipment 201A and 201B, RF tuner with which 203A and 203B receive a standard television signal, The voltage controlled oscillator which oscillates 220A and 220B on the frequency according to control voltage, The mixer compounded because 221A and 221B carry out the multiplication of the two inputs, The AGC circuit where 222A and 222B adjust the profit of a signal, the intermediate frequency processing circuit where 223A and 223B process an intermediate frequency signal, The DA converter from which 224A and 224B change a digital signal into an analog signal, A comparator [input signal / preset value /B / 225A and / 225], the voice changeover switch with which 226A and 226B output either of two audio signals, An image output terminal for 209A and 209B to output a video signal, and 210A and 210B are the audio output terminals for outputting an audio signal. Here, 201A and 201B are the 1st transceiving equipment and 2nd transceiving equipment that were indicated to claim 8, respectively.

[0093]510 is the frequency change sequence control means indicated to claim 8. While this frequency change sequence control means 510 performs a frequency change order in single direction to the higher one from the lower one from the higher one within the limits of a communication frequency list, or the lower one, A frequency change order is controlled to return to the beginning of a frequency list, when it reaches at the end of a frequency list, and it comprises the control circuit 211A and the store circuit 212A.

[0094]511 is the communication control means indicated to claim 8. By using a frequency timetable for which the 1st and 2nd transceiving equipment uses always different frequency, this communication control means 511 controls to communicate by duplex operation, i.e., both directions, and comprises the control circuit 211A and the store circuit 212A.

[0095]512 is the communication frequency list update means indicated to claim 9. While this communication frequency list update means 512 uses the communication frequency list registered at the time of a communication start and after a communication start uses the 2nd communication frequency list that reproduced the communication frequency list, The 2nd communication frequency list exchanges communicative quality result information among 2 sets of transceiving equipment, and comprises the control circuit 211A, the store circuit 212A, the comparators 214A and 225A, and the composing device 216A. And the 1st and 2nd transceiving equipment 201A and 201B is equipped with the device and the means of constituting the sending set and receiving set which were shown in drawing 5, respectively, the lot every.

[0096]Next, operation is explained. In drawing 5, if an operator pushes the detection registering button 206A of the 1st transceiving equipment 201A, the control circuit 211A will start operation. The control circuit 211A controls the RF tuner 203A so that this receives briefly all the frequency in the receiving band 303 shown in drawing 3.

[0097]The video output of the RF tuner 203A is inputted into the comparator 225A. The decision result is inputted into the control circuit 211A, and the control circuit 211A detects frequency without the video synchronizing signal by the broadcast wave and the image wave of a broadcast wave, and the random signal by an extraneous noise as frequency usable to image transmission. And these are memorized as a list to the store circuit 212A.

[0098]The 2nd transceiving equipment 201B as well as [completely] the 1st transceiving equipment 201A is constituted, and after the detection registering button 206B is pushed like the 1st transceiving equipment 201A mentioned above, a series of operations are performed.

[0099]Here, the 1st and 2nd transceiving equipment is not necessarily used by the same position or same direction. For this reason, direction of the antennas 219A and 219B differs from the arrival directions of the broadcast wave, and it is usually thought that the list which carries out detection memory as frequency usable to image transmission crosses.

[0100]Next, if one of the detection registering buttons 206A and 206B is pushed after the 1st transceiving equipment 201A and 2nd transceiving equipment 201B are connected with a cable via the communication terminals 207A and 207B, The control circuit of one transceiving equipment requires the list of frequency usable to image transmission of the control circuit of the transceiving equipment of another side via a communication terminal. Hereafter, it explains as that on which the detection registering button 206A of the 1st transceiving equipment 201A was pushed.

[0101]The control circuit 211B of the 2nd transceiving equipment 201B reads the list of usable frequency to image transmission memorized in the store circuit 212B. And this list is sent out to

the 1st transceiving equipment 201A via the communication terminal 207B.
[0102]In the 1st transceiving equipment 201A, an usable frequency list is read to image transmission memorized in the store circuit 212A, A product with the list of frequency usable to image transmission sent from the 2nd transceiving equipment 201B is taken, and while memorizing to the store circuit 212A by considering the result as a communication frequency list, it sends out also to the communication terminal 207A. In the 2nd transceiving equipment 201B, the communication frequency list sent from the 1st transceiving equipment 201A is memorized to the store circuit 212B.
[0103]Next, in drawing 5, the image transmission request signal from an external instrument shall be inputted into the external instrument control terminal 208A of the 1st transceiving equipment 201A, and the video signal from an external instrument shall be further inputted into the video input terminal 204A. At this time, the control circuit 211A reads the communication frequency list memorized in the store circuit 212A. After setting attenuation of the variable attenuator 218A as the maximum with this, RF converter 202A is operated.
[0104]Within the limits of the communication frequency list which read the control circuit 211A, For example, the lower one from the higher one as shown in the 1st row of Table 2, i.e., a left end sequence, Or RF frequency of RF converter 202A is switched at high speed by a frequency change order of changing to the higher one in single direction from the lower one, and changing so that it may return at the end of a list, when it reaches at the end of a communication frequency list further. By changing such frequency, after diffusing a power spectrum, the magnitude of attenuation of the variable attenuator 218A is made small, and transmission is started. What has decided on a change order of the frequency shown in Table 2 beforehand with the 1st transceiving equipment 201A and 2nd transceiving equipment 201B is used.
[0105]Communication frequency is switched according to the timing of the Horizontal Synchronizing signal of a video signal, or a Vertical Synchronizing signal inputted from the video input terminal 204A. The synchronized signal to be used is extracted from a video signal by the comparator 214A.
[0106]Here, in order to prevent the influence of the radio equipment on others and to aim at effective use of an electric wave, it is necessary to use RF power density per unit bandwidth transmitted as 304 or less weak level shown in drawing 6. Therefore, the control circuit 211A asks for the bandwidth of using frequency, and the dispersion ratio of a power spectrum from a communication frequency list, and thereby, it adjusts the magnitude of attenuation of the variable attenuator 218A so that RF power density per unit bandwidth may be made regularity.
[0107]On the other hand, in drawing 5, if the request signal of image reception is inputted into the external instrument control terminal 208B of the 2nd transceiving equipment 201B from an external instrument, The control circuit 208B of the 2nd transceiving equipment operates the RF tuner 203B while reading the communication frequency list memorized in the store circuit 212B.
[0108]Furthermore, the control circuit 211B of the 2nd transceiving equipment 201B within the limits of the read communication frequency list by a change order of the frequency shown in the 1st row of Table 2. The switching timing of frequency uses the pseudo synchronization timing generated inside control circuit 211B, switches the received frequency of the RF tuner 203B at high speed, and receives the RF signal from the 1st transceiving equipment 201A.
[0109]Starting reception with the 2nd transceiving equipment 201B here, during the ****, the synchronous timing of the video signal of the transmitting side and the pseudo synchronization timing of a receiver are not necessarily in agreement. Since transmit frequency and received frequency are not necessarily in agreement in time, either, the signal has not appeared in the video output of the RF tuner 203B of the 2nd transceiving equipment, and the output of the comparator 225B.
[0110]Therefore, the control circuit 211B of the 2nd transceiving equipment 201B tries detection of the sending signal of the 1st transceiving equipment by changing the timetable start time of pseudo synchronization timing and received frequency one by one, monitoring the output of the comparator 225B.
[0111]Here, since the timetable cycle of the synchronous timing of the video signal of the 1st transceiving equipment 201A and transmit frequency is constant, it succeeds in detection of the sending signal of the 1st transceiving equipment 201A after fixed trial in the 2nd transceiving equipment 201B.

[0112]If it succeeds in detection of the sending signal of the 1st transceiving equipment 201A, the control circuit 211B of the 2nd transceiving equipment 201B will use the synchronous timing of the received video signal extracted by the comparator 225B for pseudo synchronization timing, changing it.
[0113]In the 2nd transceiving equipment 201B, if detection of the sending signal from the 1st transceiving equipment 201A is completed, The control circuit 211B operates RF converter 202B, after setting attenuation of the variable attenuator 218B as the maximum while reading the communication frequency list memorized in the store circuit 212B.
[0114]Within the limits of the communication frequency list which read the control circuit 211B, For example, it is a frequency change order of changing so that it may return at the end of a list, when single direction is further arrived at [one / from the lower one or the lower one / from the higher one as shown in the 2nd row of Table 2 / higher] at the end of a communication frequency list, And a frequency timetable which uses the frequency which is not the image frequency of the frequency which has been received further always unlike the transmit frequency of the 1st transceiving equipment is used, and RF frequency of RF converter 202B is switched at high speed. Thereby, after diffusing a power spectrum, the magnitude of attenuation of the variable attenuator 218B is made small, and transmission is started.
[0115]What has decided on a change order of the frequency shown in Table 2 beforehand with the 1st transceiving equipment 201A and 2nd transceiving equipment 201B is used. Communication frequency is switched according to the synchronous timing of the video signal sent from the 1st transceiving equipment 201A that detection completed.
[0116]In order to prevent the influence of the radio equipment on others and to aim at effective use of an electric wave here, It is necessary to use RF power density per unit bandwidth transmitted as 304 or less weak level shown in drawing 3. Therefore, the control circuit 211B asks for the bandwidth of using frequency, and the dispersion ratio of a power spectrum from a communication frequency list, and it adjusts the magnitude of attenuation of the variable attenuator 218B so that RF power density per unit bandwidth may be made regularity by this.
[0117]On the other hand, in the 1st transceiving equipment 201A, after starting transmission, the RF tuner 203A is operated after the fixed time lapse defined beforehand. By a change order of the frequency for which the control circuit 211A of the 1st transceiving equipment 201A shows within the limits of a communication frequency list to the 2nd row of Table 2. The switching timing of frequency uses the synchronous timing of the transmitted video signal, switches the received frequency of the RF tuner 203A at high speed, and receives the RF signal from the 2nd transceiving equipment 201B.
[0118]Here, since reception is started with the 1st transceiving equipment 201A and transmit frequency and received frequency are not necessarily in agreement in time during the ****, the signal has not appeared in the video output of the RF tuner 203A of the 1st transceiving equipment, and the output of the comparator 225A. Therefore, the control circuit 211A of the 1st transceiving equipment 201A tries detection of the sending signal from the 2nd transceiving equipment 201B by changing the timetable start time of received frequency one by one, monitoring the output of the comparator 225A. Here, since the timetable cycle of the transmit frequency of the 2nd transceiving equipment is constant, it succeeds in detection of the sending signal of the 2nd transceiving equipment after fixed trial in the 1st transceiving equipment. Communication by duplex operation is realized between the 1st and 2nd transceiving equipment by the above.
[0119]The receiving level of the wireless transfer which generally uses a wide band is influenced by the frequency characteristic of a multipass or transmitting antennas, changes a lot like the receiving level characteristic 406 shown in drawing 7, and cannot reproduce a video signal in the frequency from which a receiving level turns into 407 or less communication marginal level.
[0120]If communication of duplex operation is realized between the 1st and 2nd transceiving equipment as mentioned above, it will become exchangeable [the frequency information which a receiving level becomes under a multipass, the influence of the frequency characteristic of transmitting antennas, etc. below in a communication marginal level].
[0121]In the 2nd transceiving equipment 201B, a false video signal is generated by the control circuit 211B, and as shown in drawing 9, on the video signal of a vertical blanking interval, the composing device 216 is used, the information on the frequency as for which below a

communication marginal level becomes is superimposed on the portion of the data 605, and it replies to the 1st transceiving equipment 201A. Furthermore, with the 2nd transceiving equipment 201B, the 2nd communication frequency list that reproduced the communication frequency list is created, and the frequency as for which below a communication marginal level becomes is excepted from the 2nd communication frequency list, and is memorized to the store circuit 212B.
[0122]In the 1st transceiving equipment 201A, a check of the frequency information as for which below the replied communication marginal level becomes will create the 2nd communication frequency list that reproduced the communication frequency list. However, while excepting the frequency as for which below the replied communication marginal level becomes from the 2nd list and memorizing it to the store circuit 212A, the transmission which uses this 2nd communication frequency list is started.
[0123]Although the sending signal of the 1st transceiving equipment detected till then disappears by the communication frequency list having changed in the 2nd transceiving equipment 201B, After the fixed time defined beforehand passes, shortly, the 2nd created communication frequency list is used and the 1st detecting operation and a series of responding operation mentioned above of a sending signal of transceiving equipment are performed again.
[0124]Although the sending signal of the 2nd transceiving equipment detected till then disappears because the communication frequency list changed also with the 1st transceiving equipment, After the fixed time defined beforehand passes, the 2nd created communication frequency list is used, detecting operation of the sending signal of the 2nd transceiving equipment is performed again, and reestablishment of the communication of duplex operation is carried out.
[0125]When the position of the 1st or the 2nd transceiving equipment changes while in use, or the situation of a multipass changes and the frequency which becomes below in a communication marginal level changes, The 1st transceiving equipment 201A that detected it changes the communication frequency list to be used from the 2nd communication frequency list to the communication frequency list of origin, and starts transmission.
[0126]Although the sending signal of the 1st transceiving equipment detected till then disappears by the communication frequency list having changed with the 2nd transceiving equipment here, After the fixed time defined beforehand passes, the communication frequency list to be used is changed to the communication frequency list of origin from the 2nd communication frequency list, While performing again the 1st detecting operation and a series of responding operation mentioned above of a sending signal of transceiving equipment, also about the transmission from a self-device, the communication frequency list to be used is changed from the 2nd communication frequency list to the communication frequency list of origin, and transmission is started.
[0127]Although the sending signal of the 2nd transceiving equipment detected till then disappears by the communication frequency list having changed in the 1st transceiving equipment 201A, After the fixed time defined beforehand passes, the communication frequency list to be used is changed from the 2nd communication frequency list to the communication frequency list of origin, detecting operation of the sending signal of the 2nd transceiving equipment is performed again, and reestablishment of the communication of duplex operation is carried out.
[0128]After reestablishment of the communication of the duplex operation which uses the communication frequency list of origin is carried out, From having returned to the communicative initial state, by a series of processings and operations which were mentioned above, the information about the frequency as for which below a communication marginal level newly becomes is exchanged, and reestablishment operation of communication of the duplex operation which uses said 2nd communication frequency list updated using the information is performed.
[0129]Here, in the operation which uses the communication frequency list of above 2nd creating and updating, transceiving equipment shall control [1st and 2nd] the RF power density per unit bandwidth automatically from operating frequency band width and a power-spectrum dispersion ratio like the above-mentioned.
[0130]As mentioned above, in communication of simplex under the influence of the frequency characteristic of a multipass or transmitting antennas. Since it can communicate without being unable to perform reproduction of a part of video signal as shown in drawing 8 (b), but a using feeling's using the frequency as for which below a communication marginal level becomes by the communication of duplex operation of the bad thing having been attained, As shown in drawing 8

(c), image transmission which canceled the influence of the frequency characteristic of a multipass or transmitting antennas is attained.
[0131]In order to prevent the influence of the radio equipment on others and to aim at effective use of an electric wave generally like Embodiment 1, the maximum of the field intensity in the point from which the wireless transmission device which uses a feeble radio wave separated only constant distance is restricted. The maximum is determined according to the stage of influence on other radio equipment which uses the same existing frequency band, and the inspecting measurement method is determined as a standard in the method of the near radio equipment which may be influenced. Control of the field intensity in the point which only constant distance left is realizable by controlling transmission power by the case where a fixed transmission antenna is used for apparatus.
[0132]Although the interaction of the radio equipment of the method which uses single frequency, and the radio equipment of the method which diffuses and uses a spectrum is great, and there is a means by which the interaction between both methods is small, Using the frequency band of standard television broadcasting about the transmission equipment of this embodiment, other existing radio equipment is television receivers which use single frequency.
[0133]Since transmission by bigger output power is possible compared with the method which uses the frequency band of standard television broadcasting and uses the conventional single frequency in the transmission equipment of this embodiment which diffuses a spectrum and transmits and received power also increases from the above reason in connection with this, transmission distance also becomes long.
[0134]In the video transmission system of this Embodiment 3, in order to use usable frequency for image transmission in advance of use, carrying out detection registration, even if digital television broadcasting and mobile communications equipment will come to use the zone in the future, it can live together.
[0135]Like Embodiment 1, since PCM transmission of an audio signal is also possible, high-definition bidirectional voice transmission is realized. Since the control signal of the external instrument connected to both transceiving equipment is superimposed on the portion of the data 605 of drawing 6 like Embodiment 2 and it can transmit bidirectionally, a still more highly efficient video transmission system is realizable.
[0136]Thus, the 1st and 2nd transceiving equipment it has the transceiving equipment, and the sending set and receiving set in transmission equipment of Embodiment 2 according to the transmission equipment of this Embodiment 3, While performing a frequency change order in single direction to the higher one from the lower one from the higher one within the limits of said communication frequency list, or the lower one, respectively, Since it was made to communicate by duplex operation by using a frequency timetable which uses the frequency from which it returns to the beginning of said frequency list, and said 1st and 2nd transceiving equipment always differs when it reached at the end of said frequency list, It also has a receiving function of television broadcasting and a controllable highly efficient and cheap duplex operation video transmission system can be mutually realized between each transceiving equipment.
[0137]While said communication frequency list registered at the time of a communication start is used and after a communication start uses the 2nd communication frequency list that reproduced said communication frequency list, Since said 2nd communication frequency list was updated as required by exchanging communicative quality result information among said 2 sets of transceiving equipment, the video transmission system which canceled the influence of a multipass is realizable.
[0138]Therefore, image transmission by duplex operation can be realized, the influence of a multipass can be canceled, and it is possible to apply to the surveillance camera for defense etc. which carry out the remote control of the camera. Although this Embodiment 3 showed the case where the digitized audio signalwas [PCM-] made to beized, it is also possible to use other compression encoding systems. Although this Embodiment 3 showed the case where NTSC system was used as a standard television signal, it is also possible to use a PAL system and an SECAM system.
[0139](Embodiment 4) This Embodiment 4 enables it to prevent interception of a feeble radio wave in collective housing in the situations in the case of using two or more transmission equipment, etc. Hereafter, the embodiment of the invention 4 is described using drawing 5,

drawing 6, drawing 7, and Table 3. This Embodiment 4 supports the invention indicated to claim 10 thru/or claim 12 and claim 22 thru/or claim 24 of this application. Drawing 5 shows the composition of the transmission equipment by the embodiment of the invention 4. Drawing 6 shows the video signal in the embodiment of the invention 4. Drawing 7 shows the condition of use in the collective housing with which the use radio wave area in the embodiment of the invention 4 has lapped indefinitely. Table 3 shows a frequency change order and frequency timetable of the embodiment of the invention 4.

[0140]

[Table 3]

	C→D	D→C	E→F	F→E	A→B	B→A
	f_1	f_{n-1}	f_n	f_{n-2}	f_{n-3}	f_{n-4}
	f_2	f_n	f_1	f_{n-1}	f_{n-2}	f_{n-3}
	f_3	f_1	f_2	f_n	f_{n-1}	f_{n-2}
時間	f_4	f_2	f_3	f_1	f_n	f_{n-1}
	f_5	f_3	f_4	f_2	f_1	f_n
	⋮	⋮	⋮	⋮	⋮	⋮
	f_n	f_{n-2}	f_{n-1}	f_{n-3}	f_{n-4}	f_{n-5}
	f_1	f_{n-1}	f_n	f_{n-2}	f_{n-3}	f_{n-4}
	f_2	f_n	f_1	f_{n-1}	f_{n-2}	f_{n-3}
	⋮	⋮	⋮	⋮	⋮	⋮

In a figure, 520 is the ID storage means indicated to claim 10. This ID storage means 520 memorizes ID added at the time of manufacture, and comprises the communication terminals 207A and 207B, the control circuits 211A and 211B, and the store circuits 212A and 212B.

[0141]521 is ID reference registration means indicated to claim 10. Mutually, it refers for this ID reference registration means 521, and it suits, registers ID between another devices which permit communication in advance of use, and comprises the detection registering buttons 206A and 206B, the communication terminals 207A and 207B, the control circuits 211A and 211B, and the store circuits 212A and 212B.

[0142]522 is the frequency setting means indicated to claim 11. This frequency setting means 522 certainly performs receiving mode before a transmitting mode, The frequency timetable of all another devices under transmission is detected in the same radio wave area, It transmits using a frequency timetable in which using frequency always differs from these another devices, and comprises the RF tuners 203A and 203B, the comparators 225A and 225B, the control circuits 211A and 211B, and the store circuits 212A and 212B.

[0143]523 is the retransmission means indicated to claim 11. When the sending signal from another device which required communication cannot be detected even if the time set beforehand passes after this retransmission means 523 performs a transmitting mode, It transmits again using a frequency timetable which is [said frequency time] comparatively different, and comprises the transmitting antennas 219A and 219B, the RF tuners 203A and 203B, the comparators 225A and 225B, the control circuits 211A and 211B, and the store circuits 212A and 212B.

[0144]524 is the output halt means indicated to claim 12. This output halt means 524 is a thing to which a sound and an image are not made to output when ID which permits communication in receiving mode cannot be checked, It comprises the control circuits 211A and 211B, the comparators 225A and 225B, the store circuits 212A and 212B, and the voice video output circuits 227A and 227B.

[0145]In this drawing 5, the 1st and 2nd transceiving equipment 201A and 201B has the device same at least and means as Embodiment 3, and it is constituted so that all operations shown in Embodiment 3 further at least may be performed. Here, ID grant device is connected to the external instrument contact buttons 208A and 208B at the time of manufacture, and ID peculiar to each device is inputted into the 1st and 2nd transceiving equipment 201A and 201B. ID to which the control devices 211A and 211B were given as ID is inputted is memorized to the store circuits

212A and 212B.
[0146]Registration of another device which permits communication is performed to the 1st and 2nd transceiving equipment 201A and 201B as follows. If one of the detection registering buttons 206A and 206B is pushed after the 1st transceiving equipment 201A and 2nd transceiving equipment 201B are connected with the communication terminals 207A and 207B, One control circuit 211A sends out the requirement signal of ID to the control circuit 211B of the 2nd transceiving equipment via the communication terminal 207A.
[0147]Hereafter, it explains that the detection registering button 206A is pushed. The control circuit 211B of the 2nd transceiving equipment 201B that received the requirement signal of ID reads ID peculiar to the self-device memorized in the store circuit 212B, and sends this out to the 1st transceiving equipment 201A via the communication terminal 207B.
[0148]As for the control circuit 211A of the 1st transceiving equipment 201A that received ID of the 2nd transceiving equipment 201B, received ID is memorized to the store circuit 212A as ID of another device which permits communication. With this, ID peculiar to a self-device is sent out towards the 2nd transceiving equipment 201B via the communication terminal 207A.
[0149]As for the control circuit 212B of the 2nd transceiving equipment 201B that received ID of the 1st transceiving equipment 201A, received ID is memorized to the store circuit 212B as ID of another device which permits communication. Above, the 1st and 2nd transceiving equipment 201A and 201B completes [both] registration of another device which permits communication.
[0150]In drawing 10, as for each class of the transceiving equipment A, the transceiving equipment B, the transceiving equipment C and the transceiving equipment D, the transceiving equipment E, and the transceiving equipment F, registration of each transceiver layer has completed a partner's transceiving equipment mutually as another device which permits communication. It is in the state where C, D, and E and F are communicating now using the frequency timetable from the 1st row of Table 3 to the fourth row, in this figure. In drawing 10, a, b, c, d, e, and f show the attainment area of the electric wave of the transceiving equipment A, B, and C, D, E, and F, respectively. In the above-mentioned state, the operation to which the transceiving equipment A performs transmission of a call, and an image and a sound towards the transceiving equipment B, and the transceiving equipment B performs response and transmission of an image and a sound to the transceiving equipment A further is explained below. The transceiving equipment A and the transceiving equipment B are equivalent to the transceiving equipment 201A and the transceiving equipment 201B of drawing 5, respectively.
[0151]In drawing 5, if the image transmission request signal from an external instrument is inputted into the external instrument control terminal 208A of the transceiving equipment 201A and the video signal from an external instrument is further inputted into the video input terminal 204A, The control circuit 211A operates the RF tuner 203A, and performs receiving mode before a transmitting mode while it reads the communication frequency list memorized in the store circuit 212A.
[0152]In receiving mode, the control circuit 211A of the transceiving equipment 201A within the limits of the read communication frequency list by a change order of the frequency shown in the fifth row of Table 3. The switching timing of frequency uses the pseudo synchronization timing generated inside the control circuit 211A, switches the received frequency of the RF tuner 203A at high speed, and receives the RF signal from another device under transmission in the same radio wave area.
[0153]As shown in drawing 10, here around the transceiving equipment A, The transceiving equipment B and C exists in radio wave arrival area, and the transceiving equipment D, and E and F exist outside radio wave arrival area, further, the transceiving equipment A and E exists in radio wave arrival area, and the transceiving equipment C, and D and F exist in the circumference of the transceiving equipment B outside radio wave arrival area. In order to detect each other's another device which permits communication, respectively, the transceiving equipment C, D, and E which is transmitting, and F superimposed ID respectively peculiar to a self-device on the portion of the data 605 shown in drawing 6 on a transmission video image signal, and have transmitted to it.
[0154]First, reception is started with the transceiving equipment 201A, and the synchronous timing of the video signal which surrounding transceiving equipment transmits, and the pseudo synchronization timing of a receiver are not necessarily in agreement during the ****. Since

transmit frequency and received frequency are not necessarily in agreement in time, either, the signal has not appeared in the video output of the RF tuner 203A, and the output of the comparator 225A.
[0155]Therefore, the control circuit 211A of the transceiving equipment 201A tries detection of the sending signal of surrounding transceiving equipment by changing the timetable start time of pseudo synchronization timing and received frequency one by one, monitoring the output of the comparator 225A.
[0156]The transceiving equipment C here in the circumference radio wave arrival area of the transceiving equipment A The 1st row of Table 3, That is, it is transmitting using the frequency timetable shown in a left end sequence, and since the timetable cycle of the synchronous timing of the video signal which the transceiving equipment C transmits, and transmit frequency is constant, it succeeds in detection of the sending signal of the transceiving equipment C after fixed trial in the transceiving equipment A.
[0157]If it succeeds in detection of a sending signal, the transceiving equipment A will use the synchronous timing of the received video signal extracted by the comparator 225A for pseudo synchronization timing, changing it. With this, the comparator 225A extracts the portion of the data 605 of drawing 6, and ID peculiar to the transceiving equipment which has transmitted this signal is read. And when read ID is not another device which has permitted communication, the frequency timetable used now is memorized to the store circuit 212A as a list during the another surrounding transceiving equipment group's use.
[0158]Detection of the sending signal of surrounding transceiving equipment is tried by changing the timetable start time of pseudo synchronization timing and received frequency one by one, monitoring the output of the comparator 225A for whether furthermore the transceiving equipment A has another device under transmission further into radio wave arrival area continuously.
[0159]If it becomes clear that the timetable start time of pseudo synchronization timing and received frequency is changed briefly, and there is no another device in the circumference after detection of a sending signal here in addition to the transceiving equipment C, The control circuit 211A of the transceiving equipment A during the memorized use Except a list, For example, after diffusing a power spectrum using the frequency timetable of the third row of Table 3 by switching RF frequency of RF converter 202A at high speed, the transmission which makes small the magnitude of attenuation of the variable attenuator 218A, and starts transmission is started.
[0160]On the other hand, in drawing 5, if the request signal of image reception is inputted into the external instrument control terminal 208B of the transceiving equipment 201B from an external instrument, The control circuit 208B of transceiving equipment operates the RF tuner 203B while reading the communication frequency list memorized in the store circuit 212B.
[0161]Within the limits of the communication frequency list which the control circuit 211B of the transceiving equipment 201B read by a change order of the frequency shown in the 6th row of Table 3. The switching timing of frequency uses the pseudo synchronization timing generated inside control circuit 211B, switches the received frequency of the RF tuner 203B at high speed, and receives the RF signal from the transceiving equipment A.
[0162]Here, reception is started with the transceiving equipment B and the synchronous timing of the video signal of the transmitting side and the pseudo synchronization timing of a receiver are not necessarily in agreement during the ****. Since transmit frequency and received frequency furthermore are not necessarily in agreement in time, either, the signal has not appeared in the video output of the RF tuner 203B, and the output of the comparator 225B. Therefore, the control circuit 211B of the transceiving equipment 201B tries detection of the sending signal of the transceiving equipment A by changing the timetable start time of pseudo synchronization timing and received frequency one by one, monitoring the output of the comparator 225B.
[0163]Here, in both the circumference radio wave arrival area of the transceiving equipment B, it is assumed that the transceiving equipment A and the transceiving equipment E are transmitting using the frequency timetable shown in the third row of Table 3. Since the timetable cycle of the synchronous timing of the video signal which transceiving equipment A-E transmits, and transmit frequency is constant, it detects the sending signal from both transceiving equipment A-E after fixed trial in the transceiving equipment B.
[0164]If it succeeds in detection of a sending signal, the transceiving equipment B will try in order that the comparator 225B may extract the synchronous timing of a received video signal.

However, the signal of the transceiving equipment A and E laps, and since mutual interference of the input signal is carried out, it does not serve as a cycle of a normal synchronized signal. Therefore, in the transceiving equipment B, transmission for a response is not performed but it goes into the detecting operation of another sending signal.

[0165]In the transceiving equipment A, after starting transmission, receiving mode is continued using RF tuner, but even if the time set beforehand passes, the reply signal from the transceiving equipment B which required communication is undetectable. For this reason, the transceiving equipment A starts transmission again using a frequency timetable which is different from what is being used further now during use unlike a list, for example, the frequency timetable shown in the fifth row of Table 3. In the transceiving equipment B, since the detecting operation of another sending signal is continued, the sending signal from the transceiving equipment A which uses different frequency timetables from the transceiving equipment E is detected normally shortly.

[0166]If it succeeds in detection, the transceiving equipment B will use the synchronous timing of the received video signal extracted by the comparator 225B for pseudo synchronization timing, changing it. If it succeeds in detection, the transceiving equipment B will use the synchronous timing of the received video signal extracted by the comparator 225B for pseudo synchronization timing, changing it. With this, the transceiving equipment B extracts the portion of the data 605 of drawing 6 with the comparator 225B further, and reads ID peculiar to the transceiving equipment which has transmitted this signal. And it checks that the signal received from read ID now is a signal from the transceiving equipment A which has permitted communication.

[0167]In the transceiving equipment B, if detection of the sending signal from the transceiving equipment A and the check of ID are completed, The control circuit 211B operates RF converter 202B, after setting attenuation of the variable attenuator 218B as the maximum while reading the communication frequency list memorized in the store circuit 212B.

[0168]Within the limits of the communication frequency list which read the control circuit 211B, For example, after diffusing a power spectrum using the frequency timetable shown in the sixth row of Table 3 by switching RF frequency of RF converter 202B at high speed, the magnitude of attenuation of the variable attenuator 218B is made small, and transmission is started.

[0169]Communication frequency is switched according to the synchronous timing of the video signal sent from the transceiving equipment A which detection completed. On the other hand, in the transceiving equipment A, since receiving mode is continued using RF tuner, the reply signal from the transceiving equipment B is detected.

[0170]Here, since it differs from the frequency timetable which another transceiving equipment group in the circumference radio wave arrival area of the transceiving equipment A is using as shown in Table 3, the reply signal from the transceiving equipment B serves as good reception.

[0171]If it succeeds in detection of a sending signal, the transceiving equipment A will try to extract the reply signal on which the received video signal is overlapped. And from the received video signal in a good receive state, since a normal reply signal is checked, with the transceiving equipment A, the response of a duplex operation communication success is superimposed on the video signal which is already under transmission, and is sent out. In the transceiving equipment B, if the reply signal of a duplex operation communication success is checked, the frequency timetable used henceforth will be fixed and a channel will be secured.

[0172]In the above-mentioned process, when the frequency timetable which the transceiving equipment B uses laps comparatively the frequency time of the 1st row of Table 3, with the transceiving equipment A, the reply signal from B cannot be checked and the reply signal of a duplex operation communication success is not transmitted, either. In the transceiving equipment B, since the reply signal of a duplex operation communication success from the transceiving equipment A cannot be checked even if the time set beforehand passes, it comes back to a receive state with the good above by starting transmission using a further different frequency timetable, for example, the frequency timetable of the 6th row of Table 3.

[0173]When communication frequency lists differ into transceiving equipment group CD and the transceiving equipment group AB in the above-mentioned process, Since mutual interference decreases according to the time ratio which is using the same frequency simultaneously, it does not generate, but a parenchyma top interaction will be in the same state as there is no another transceiving equipment group who is transmitting to the circumference, and the good communication of it will be attained. It enables use radio wave area to cancel interference by the

above in the collective housing with which it may lap indefinitely.
[0174]In the above-mentioned process, although the transceiving equipment A and B may detect the sending signal of the transceiving equipment C and E, respectively, When ID on which it is superimposed on the received video signal cannot check that it is a thing from another device which has permitted communication, a sound and a video signal are not outputted by the voice video output circuits 227A and 227B of drawing 5. Thereby, it is not concerned with a user's intention but it becomes possible to prevent interception.
[0175]Thus, in [according to the transmission equipment of this Embodiment 4] the transmission equipment of Embodiment 2 or 3, Since a reference was made, and it suits and ID was mutually registered between another devices which memorize ID added at the time of manufacture, and permit communication in advance of use, the video transmission system which use radio wave area canceled interference in the collective housing with which it may lap indefinitely, and prevented interception is realizable.
[0176]Certainly perform receiving mode before a transmitting mode, and the frequency timetable of all another devices under transmission is detected in the same radio wave area, It transmits using a frequency timetable in which using frequency always differs from these another devices, When the sending signal from another device which required communication cannot be detected even if the time set beforehand passes after performing a transmitting mode, Since it was made to transmit again using a frequency timetable which is [said frequency time] comparatively different, the video transmission system with which use radio wave area canceled interference in the collective housing with which it may lap indefinitely is realizable.
[0177]Since it was made not to output a sound and an image when ID which permits communication in receiving mode was not able to be checked, the video transmission system with which use radio wave area prevented interception in the collective housing with which it may lap indefinitely is realizable. Therefore, in the collective housing with which it may lap indefinitely, use radio wave area can cancel interference, interception can be prevented, and it is possible to apply to a door television phone, the indoor wireless terminal of a TV phone, etc.
[0178]Although this Embodiment 4 showed the case where the digitized audio signalwas [PCM-] made to beized, it is also possible to use other compression encoding systems. Although this Embodiment 4 showed the case where NTSC system was used as a standard television signal, it is also possible to use a PAL system and an SECAM system.
[0179]
[Effect of the Invention]As mentioned above, according to the transmission equipment concerning the invention of this invention according to claim 1. The sending office which transmits an image or a sound using a feeble radio wave, and the receiving office which transmits an image or a sound using a feeble radio wave, Have a relay station arranged between said sending office and the receiving office which have been arranged exceeding the range of said feeble radio wave, and from said sending office to a sending signal. Including the information which shows the address of a receiving office in addition to original information, including an image, a sound, etc., and the information which shows the frequency which a local station receives from a relay station, said relay station, While becoming irregular and outputting to different frequency from the frequency of the feeble radio wave which received from said sending office, from the receiving office side, add the information on the frequency which a local station receives, transmit, and said receiving office, Since the transmission line of the sending office and a receiving office was established by modulating a feeble radio wave in the frequency which said relay station specified, and transmitting an image and a sound to it when it had recognized that it was a signal addressed to a local station, When transmitting an image and a sound using a feeble radio wave, there is an effect whose transmission in case the distance of the sending office and a receiving office exceeds the range of a feeble radio wave is attained.
[0180]According to the transmission equipment concerning the invention of this invention according to claim 2, in the transmission equipment according to claim 1, to the sending signal of the outward trip turned to said receiving office from said sending office. Since the information which shows the received frequency which uses a standard television signal and the address of a PCM sound signal and a receiving office and a local station specify as the vertical blanking interval of a video signal was superimposed, When transmitting an image and a sound using a feeble radio wave, there is an effect whose transmission in case the distance of the sending office

and a receiving office exceeds the range of a feeble radio wave is attained.
[0181]A sending set which was provided with the RF converter which generates a standard television signal according to the transmission equipment concerning the invention of this invention according to claim 3, A receiving set provided with RF tuner which receives a standard television signal, The usable frequency detection means which detects frequency usable to image transmission in the receiving band of said RF tuner in advance of use, A detection frequency registration means to register with said both transceiving equipment by considering detected frequency as a communication frequency list, Since it had the spread spectrum communication means which communicates by diffusing a power spectrum by switching frequency within the limits of said communication frequency list, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission and advanced features are possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the video transmission system which can live together.
[0182]In [according to the transmission equipment concerning the invention of this invention according to claim 4] the transmission equipment according to claim 3, Since it had a transmission-power-control means to change automatically the transmission power in the case of said communication according to operating frequency band width so that the power flux density per unit bandwidth might become fixed, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission and advanced features are possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the video transmission system which can live together.
[0183]In [according to the transmission equipment concerning the invention of this invention according to claim 5] the transmission equipment according to claim 3 or 4, Since it had the frequency switching means which switches the frequency in the case of said communication synchronizing with the synchronous timing of a video signal, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission and advanced features are possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the video transmission system which can live together.
[0184]In [according to the transmission equipment concerning the invention of this invention according to claim 6] the transmission equipment according to any one of claims 3 to 5, Since it had the control signal superposition transmission means which superimposes a control signal on the video signal of a blanking period, and transmits it in the case of said communication, While having a standard television broadcasting receiving function of NTSC system, the influence of a multipass can be reduced and it can have advanced features, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the video transmission system which can live together.
[0185]In [according to the transmission equipment concerning the invention of this invention according to claim 7] the transmission equipment according to any one of claims 3 to 6, Since it had the audio signal superposition transmission means which PCM-izes an audio signal, and is superimposed and transmitted on the video signal of a blanking period in the case of said communication, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission is possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the video transmission system which can live together.
[0186]The 1st and 2nd transceiving equipment that consists of transmission equipment indicated

to either of claims 3 thru/or 7, respectively according to the transmission equipment concerning the invention of this invention according to claim 8, While performing a frequency change in single direction to the higher one from the lower one or the lower one from the one where frequency is higher within the limits of said communication frequency list in the case of said communication, A frequency change sequence control means to control a frequency change order to return to the beginning of said frequency list when frequency reaches at the end of said frequency list, Since said 1st and 2nd transceiving equipment was provided with the communication control means which controls to communicate by duplex operation by using a frequency timetable which uses always different frequency, While realizing image transmission by duplex operation, it is effective in the ability to provide the video transmission system which canceled the influence of a multipass.

[0187]In [according to the transmission equipment concerning the invention of this invention according to claim 9] the transmission equipment according to claim 8, While said communication frequency list registered a priori at the time of the start of said communication is used and after a communication start uses the 2nd communication frequency list that reproduced said communication frequency list, Since it had the communication frequency list update means which updates said 2nd communication frequency list as required by exchanging communicative quality result information among said 2 sets of transceiving equipment, while realizing image transmission by duplex operation, it is effective in the ability to provide the video transmission system which canceled the influence of a multipass.

[0188]In the transmission equipment which was indicated to either of claims 3 thru/or 9 according to the transmission equipment concerning the invention of this invention according to claim 10, Since it had an ID reference registration means to make a reference, to have suited and to register ID mutually between the ID storage means which memorizes the identification number (ID is called hereafter) added to transmission equipment at the time of manufacture, and other transmission equipment which permits communication in advance of use, It is effective in the ability to provide the video transmission system which use radio wave area cancels interference in the collective housing with which it may lap indefinitely, and prevents interception.

[0189]In [according to the transmission equipment concerning the invention of this invention according to claim 11] the transmission equipment according to claim 10, Certainly perform receiving mode before a transmitting mode, and the frequency timetable of other transmission equipment of all the under transmission is detected in the same radio wave area, The frequency setting means which transmits using a frequency timetable in which using frequency always differs from all the transmission equipment besides these, When the sending signal from another device which required communication cannot be detected even if the time set beforehand passes after performing a transmitting mode, Since it had the retransmission means which transmits again using a frequency timetable which is [said frequency time] comparatively different, it is effective in the ability to provide the video transmission system which use radio wave area cancels interference in the collective housing with which it may lap indefinitely, and prevents interception.

[0190]When ID which permits communication in receiving mode cannot be checked in the transmission equipment according to claim 10 or 11 according to the transmission equipment concerning the invention of this invention according to claim 12, Since it had the output halt means to which original information, including a sound or an image, is not made to output, it is effective in the ability to provide the video transmission system which use radio wave area cancels interference in the collective housing with which it may lap indefinitely, and prevents interception.

[0191]According to the transmission method concerning the invention of this invention according to claim 13, it is a transmission method for transmitting an image or a sound mutually between the sending office and a receiving office using a feeble radio wave, Arrange a relay station between said sending office and the receiving office which have been arranged exceeding the range of said feeble radio wave, and from said sending office to a sending signal. Including the information which shows the address of a receiving office in addition to original information, including an image, a sound, etc., and the information which shows the frequency which a local station receives from a relay station, said relay station, While becoming irregular and outputting to different frequency from the frequency of the feeble radio wave which received from said sending

office, from the receiving office side, add the information on the frequency which a local station receives, transmit, and said receiving office, Since the transmission line of the sending office and a receiving office was established by modulating a feeble radio wave in the frequency which said relay station specified, and transmitting an image and a sound to it when it had recognized that it was a signal addressed to a local station, When transmitting an image and a sound using a feeble radio wave, there is an effect which enables transmission in case the distance of the sending office and a receiving office exceeds the range of a feeble radio wave.

[0192]According to the transmission equipment concerning the invention of this invention according to claim 14, in the transmission method according to claim 13, to the sending signal of the outward trip turned to said receiving office from said sending office. Since the information which shows the received frequency which uses a standard television signal and the address of a PCM sound signal and a receiving office and a local station specify as the vertical blanking interval of a video signal was superimposed, When transmitting an image and a sound using a feeble radio wave, there is an effect which enables transmission in case the distance of the sending office and a receiving office exceeds the range of a feeble radio wave.

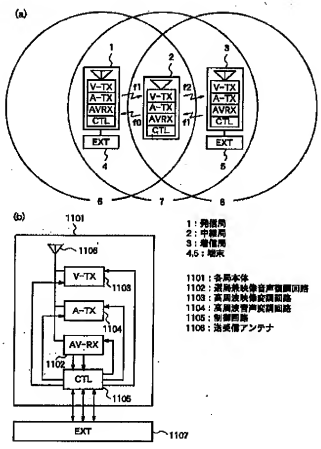
[0193]A sending set which was provided with the RF converter which generates a standard television signal according to the transmission method concerning the invention of this invention according to claim 15, It is the method of transmitting between the receiving sets provided with RF tuner which receives a standard television signal, In advance of use, frequency usable to image transmission is detected in the receiving band of said RF tuner, Since it registers with said both transceiving equipment by considering detected frequency as a communication frequency list and was made to communicate by diffusing a power spectrum by switching frequency within the limits of said communication frequency list, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission and advanced features are possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the image transmission method which can live together.

[0194]In [according to the transmission method concerning the invention of this invention according to claim 16] the transmission method according to claim 15, Since it was made to change automatically the transmission power in the case of said communication according to operating frequency band width so that the power flux density per unit bandwidth might become fixed, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission and advanced features are possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the image transmission method which can live together.

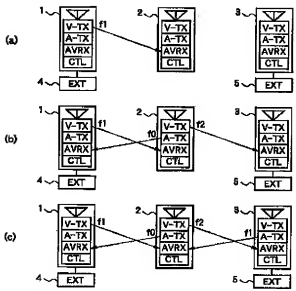
[0195]Since the frequency in the case of said communication was switched in the transmission method according to claim 15 or 16 synchronizing with the synchronous timing of a video signal according to the transmission method concerning the invention of this invention according to claim 17, While having a standard television broadcasting receiving function of NTSC system, reduce the influence of a multipass and high-definition voice transmission and advanced features are possible, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the image transmission method which can live together.

[0196]Since according to the transmission method concerning the invention of this invention according to claim 18 a control signal is superimposed on the video signal of a blanking period and was transmitted in the transmission method according to any one of claims 15 to 17 on the occasion of said communication, While having a standard television broadcasting receiving function of NTSC system, the influence of a multipass can be reduced and it can have advanced features, Even if a long-distance communication range is realized and digital television broadcasting and mobile communications equipment will come to use the zone rather than the case where single frequency is used in the future, it is effective in the ability to provide the image transmission method which can live together.

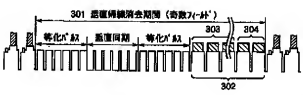
Drawing 1



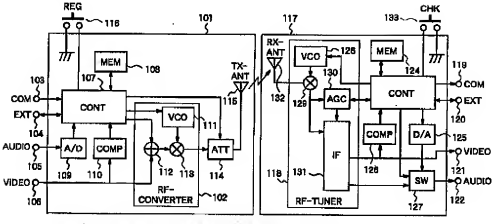
Drawing 2



Drawing 3

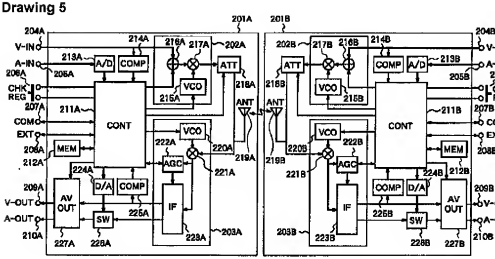


Drawing 4



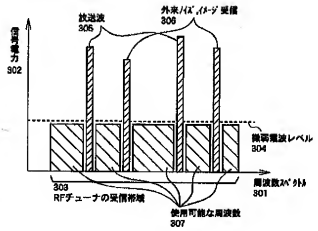
500(118,123,124,126,133)：使用可能周波数検出手段
504(106,110,126,107,123)：周波数切り替え手段
505(104,120,107,123,110,125,112)：制御信号重畳手段
506(105,122,109,125,107,123,110,126,112,127)：音声信号重畳制御手段
501(103,119,107,123,108,124,116)：周波数登録手段
502(107,123,108,124,102,116)：スペクトル拡散送信手段
503(107,106,114)：送信電力制御手段
101：送信装置
117：受信装置

Drawing 5

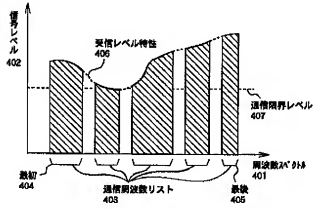


524(211A,211B,225A,225B,212A,212B,227A,227B)：出力停止手段
523(219A,219B,203A,203B,225A,225B,211A,211B,212A,212B)：周波数手段
522(203A,203B,225A,225B,211A,211B,212A,212B)：周波数設定手段
520(207A,207B,211A,211B,212A,212B)：ID記憶手段
521(206A,206B,207A,207B,211A,211B,212A,212B)：ID照合登録手段
510(211A,212A)：周波数切り替え順序制御手段
511(211A,212A)：送信制御手段
512(211A,212A,214A,225A,216A)：送信周波数リスト更新手段

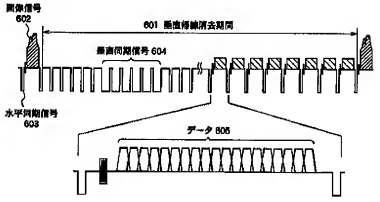
Drawing 6



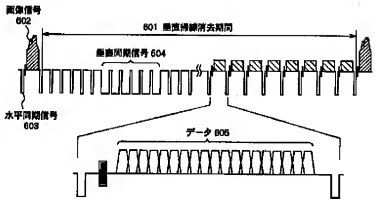
Drawing 7



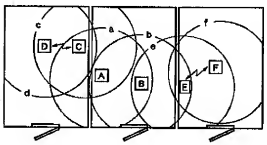
Drawing 8



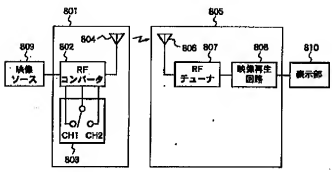
Drawing 9



Drawing 10



Drawing 11



US007209746B1

(12) **United States Patent**
Kirino et al.

(10) **Patent No.: US 7,209,746 B1**
(45) **Date of Patent: Apr. 24, 2007**

(54) **APPARATUS AND METHOD FOR WIRELESS VIDEO AND AUDIO TRANSMISSION UTILIZING A MINUTE-POWER LEVEL WAVE**

(75) Inventors: **Hideki Kirino**, Ayauta-gun (JP); **Tetsuo Hiraga**, Niihama (JP)

(73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/423,356**

(22) PCT Filed: **Mar. 31, 1999**

(86) PCT No.: **PCT/JP99/01682**

§ 371 (c)(1),
(2), (4) Date: **Jun. 21, 2000**

(87) PCT Pub. No.: **WO99/52287**

PCT Pub. Date: **Oct. 14, 1999**

(30) **Foreign Application Priority Data**

Mar. 31, 1998 (JP) 10-085706

(51) **Int. Cl.**
G04Q 7/20 (2006.01)

(52) **U.S. Cl.** **455/450**; 455/3; 455/5.1; 455/11.1; 455/42; 370/384; 395/200.77; 386/104

(58) **Field of Classification Search** 455/5.1, 455/11.1, 42, 450, 3; 398/67, 68, 66; 386/104, 386/124, 95, 125; 725/118, 119, 148, 149, 725/150, 121–123, 87, 91, 95; 348/723; 370/384; 395/200.77

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,038,402	A *	8/1991	Robbins	455/3
5,751,707	A *	5/1998	Voit et al.	370/384
5,761,437	A *	6/1998	Takano	395/200.77
5,793,413	A *	8/1998	Hylton et al.	348/12
5,794,116	A *	8/1998	Matsuda et al.	455/5.1
6,091,932	A *	7/2000	Langlais	455/5.1
6,259,443	B1 *	7/2001	Williams, Jr.	345/329
6,282,366	B1 *	8/2001	Oguro et al.	386/104

FOREIGN PATENT DOCUMENTS

JP	62-56031	3/1987
JP	2-156744	6/1990
JP	3-145365	6/1991
JP	4-326887	11/1992
JP	7-029100	1/1995
JP	7-221711	8/1995
JP	8-139653	5/1996
JP	9-27951	1/1997
JP	9-163355	6/1997
JP	9-186690	7/1997
JP	10-23392	1/1998

* cited by examiner

Primary Examiner—Joseph Feild
Assistant Examiner—Pierre-Louis Desir
(74) *Attorney, Agent, or Firm*—Steptoe & Johnson LLP

(57) **ABSTRACT**

The present invention is to provide an inexpensive transmission apparatus which has the function of receiving standard television broadcasting, uses a minute-power wave, and is able to coexist with future digital television broadcasting or mobile communication equipment which will use the same frequency band as that of the transmission apparatus.

By using an RF converter **102** and an RF tuner **118** which are adapted to a standard television signal, available frequencies within the reception band are detected, and the use frequency is rapidly changed to spread the spectrum, thereby performing communication by the minute-power wave.

4 Claims, 8 Drawing Sheets

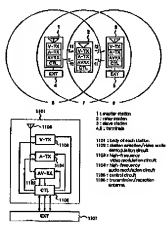


Fig.1 (a)

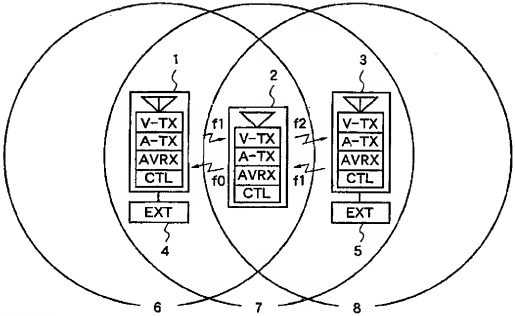
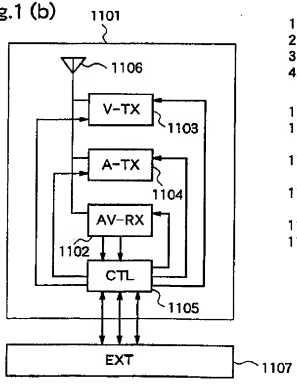


Fig.1 (b)



1 : master station
2 : relay station
3 : slave station
4,5 : terminals

1101 : body of each station
1102 : station selection/video audio demodulation circuit
1103 : high-frequency video modulation circuit
1104 : high-frequency audio modulation circuit
1105 : control circuit
1106 : transmission/reception antenna

Fig.2 (a)

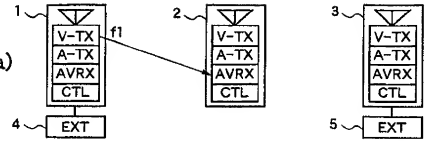


Fig.2 (b)

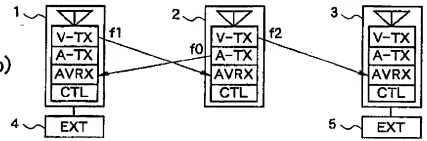


Fig.2 (c)

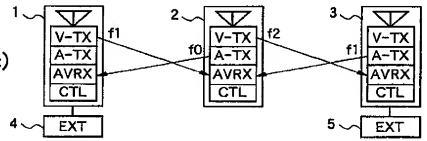


Fig.3

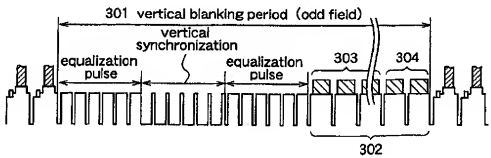
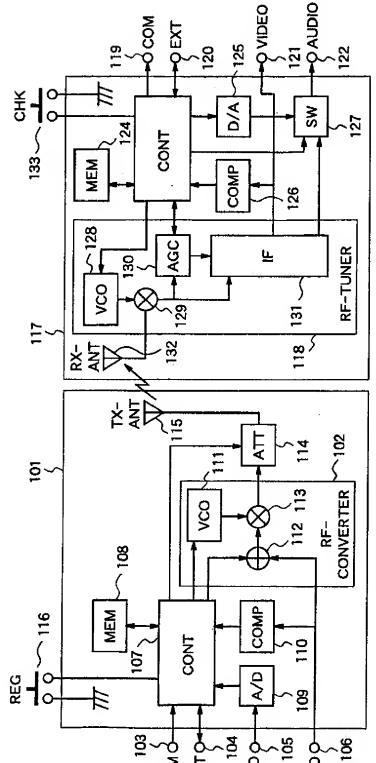
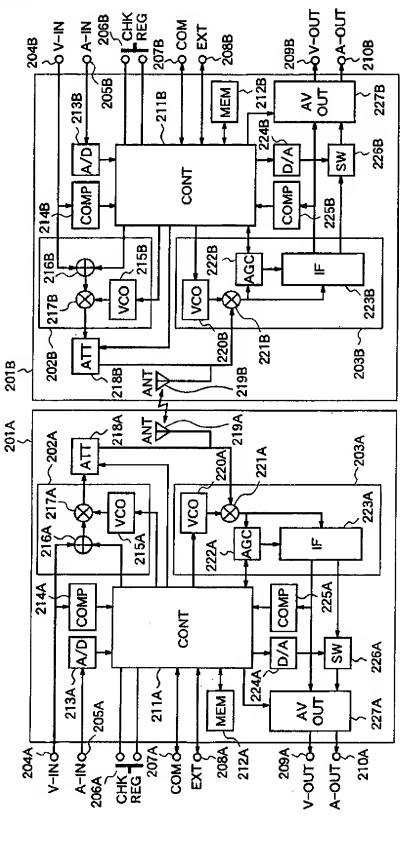


Fig. 4



500(118,123,124,126,133) : available frequency detection means
504(106,110,126,107,123) : frequency changing means
505(104,120,107,123,110,125,112) : control signal superposition means
506(105,122,109,125,107,123,110,126,112,127) : audio signal superposition control means
501(103,119,107,123,108,124,116) : frequency registration means
502(107,123,108,124,102,118) : spread spectrum communication means
503(107,108,114) : transmission power control means
101 : transmission apparatus
117 : receiving apparatus

Fig. 5



524(211A,211B,225A,225B,212A,212B,227A,227B) : output stop means
523(219A,219B,203A,203B,225A,225B,211A,211B,212A,212B) : retransmission means
522(203A,203B,225A,225B,211A,211B,212A,212B) : frequency setting means
520(207A,207B,211A,211B,212A,212B) : ID storage means
521(206A,206B,207A,207B,211A,211B,212A,212B) : ID inquiry/registration means
510(211A,212A) : frequency changing order control means
511(211A,212A) : communication control means
512(211A,212A,214A,225A,216A) : communication frequency list updation means

Fig. 6

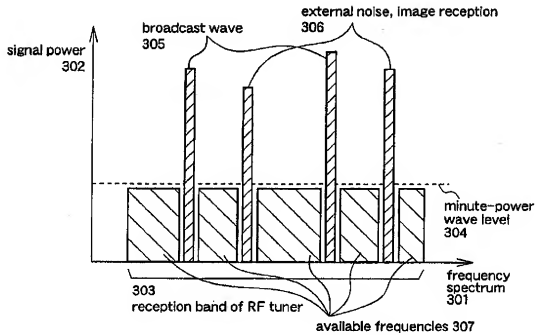

external noise, image reception
306
broadcast wave
305
signal power
302
minute-power
wave level
304
frequency
spectrum
301
303
reception band of RF tuner
available frequencies 307

Fig. 7

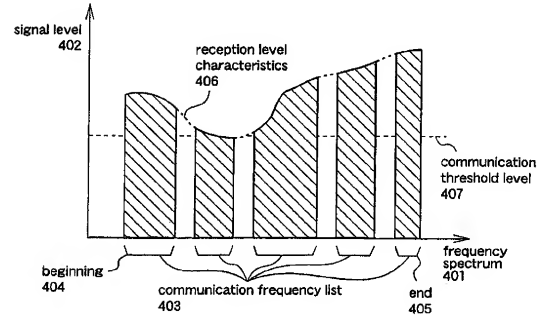

signal level
402
reception level
characteristics
406
communication
threshold level
407
frequency
spectrum
401
beginning
404
communication frequency list
403
end
405

Fig.8 (a)

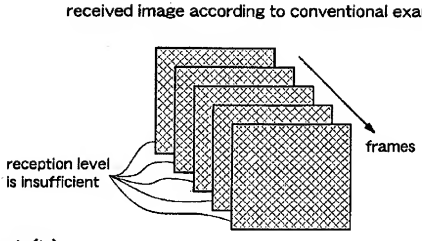


Fig.8 (b)

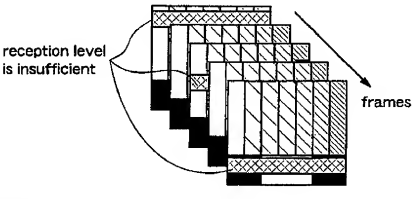


Fig.8 (c)

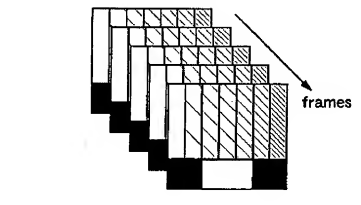


Fig. 9

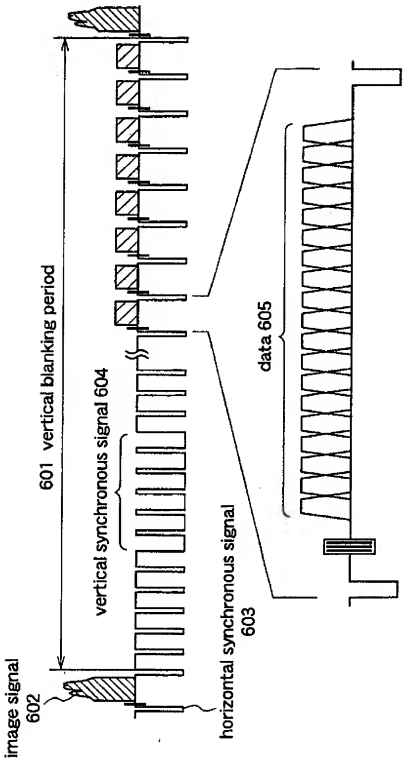

601 vertical blanking period
vertical synchronous signal 604
data 605
image signal 602
horizontal synchronous signal 603

Fig.10

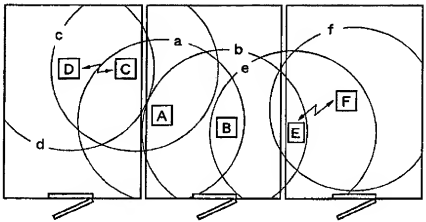
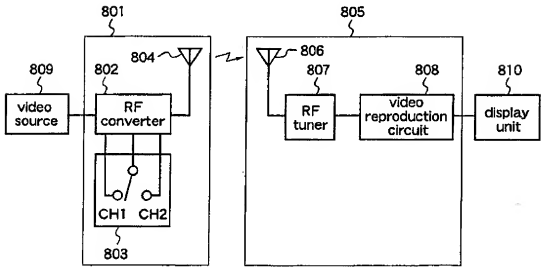

c
a
b
f
D
C
e
F
A
B
E
d

Fig.11


801
805
804
806
809
802
807
808
810
video source
RF converter
RF tuner
video reproduction circuit
display unit
CH1
CH2
803

APPARATUS AND METHOD FOR WIRELESS VIDEO AND AUDIO TRANSMISSION UTILIZING A MINUTE-POWER LEVEL WAVE

TECHNOLOGICAL FIELD

The present invention relates to a transmission apparatus and a transmission method for transmitting video and audio between apparatuses which are connected by wireless, utilizing a wave of minute-power level.

Particularly, the present invention relates to a transmission apparatus and a transmission method, which enable transmission of information between apparatuses which are placed apart from each other by a distance longer than the reachable range of the minute-power wave.

Furthermore, the present invention relates to a transmission apparatus and a transmission method, which have the function of receiving NTSC system standard television broadcasting, reduce the influence of multi-path, enable high-definition audio transmission and highly efficient performance, and realize a communication distance longer than that in the case of using a single frequency.

Furthermore, the present invention relates to a transmission apparatus and a transmission method, which realize duplex video transmission and solve the influence of multi-path.

Moreover, the present invention relates to a transmission apparatus and a transmission method which solve radio interference and prevent interception, in the case where a plurality of apparatuses are used simultaneously in a multiple dwelling house or the like where the use wave areas may overlap uncertainly.

BACKGROUND ART

To date, as for video signal transmission in a front-door visual phone or the like, cable transmission using coaxial cables or parallel cables has been adopted. However, because of the facility of fitting work, adoption of a wireless video transmission system, in which a parent unit and a child unit are connected by utilizing a radio wave, is considered.

Further, as a method for receiving standard television broadcasting as well as performing wireless video transmission, there has been studied a method in which one channel is selected from vacant channels of a television and video is transmitted by utilizing a minute-power wave. This method uses an RF converter for generating a standard television signal and an RF tuner for receiving the standard television signal.

Further, as another means, there has been studied a method in which an RF tuner is used for receiving broadcasting, and a digitized video signal is transmitted by using a small-power radio transmitter-receiver, in combination with the data compression/decompression technique.

FIG. **11** shows a video transmission device as an example of a conventional transmission apparatus using a minute-power wave.

In FIG. **11**, **801** denotes a transmitter for transmitting a video signal, **809** denotes a video source for outputting the video signal to the transmitter **801**, **802** denotes an RF converter for generating a standard television signal, **803** denotes a channel switch for selecting a transmission frequency of the RF converter **802**, and **804** denotes a transmission antenna of the transmitter **801**. Further, **805** denotes a receiver for receiving the video signal, **806** denotes a receiving antenna of the receiver **805**, **807** denotes an RF tuner for receiving the standard television signal, **808** denotes a video reproduction circuit for reproducing the video signal demodulated by the RF tuner **807**, and **810** denotes a display unit for displaying the video from the receiver **805**.

Next, the operation will be described. In the above-described structure, in the transmitter **801**, a frequency signal selected by the channel switch **803** is modulated with the video signal from the video source **809** by the RF converter **802**. Then, in the transmitter **801**, the modulated signal is transmitted through the transmission antenna **804**. On the other hand, in the receiver **805**, the video reproduction circuit **808** reproduces the video signal from the signal selectively received by the receiving antenna **806** and the RF tuner **807**, and the display unit **810** displays the video.

In such wireless transmission utilizing a radio wave, since the wave is a limited resource, it is appropriate to utilize a minute-power wave in a place where the available range is limited, such as in a house. The minute-power wave is a wave which hardly affect a wireless apparatus such as a television receiver in a house. However, the reachable range of the minute-power wave is short and, therefore, the distance between a parent unit and a child unit which use the minute-power wave is unfavorably limited.

The present invention is made to solve the above-described technological problem of the conventional apparatus, and it is an object of the present invention to provide a transmission apparatus which can establish a transmission path between a master station and a slave station, such as a parent unit and a child unit, which are placed apart by a distance longer than the reachable range of a minute-power wave.

Further, in the conventional transmission apparatus, since the transmission power is at the minute-power level and the reception sensitivity is low even in short-distance transmission, the influence of multi-path is considerable.

Furthermore, there is a risk that the minute-power radio apparatus using the frequency band of the standard television broadcasting will adversely affect reception of existing television broadcasting. Moreover, the minute-power radio apparatus will become unavailable when being affected by a strong existing broadcast wave.

Furthermore, in order to implement the above-described method in which an RF tuner is used for receiving broadcasting and a digitized video signal is transmitted using a small-power radio transmitter-receiver in combination with the data compression/decompression technique, the following apparatuses are required: an RF tuner, an AD converter, a DA converter, a compression/decompression processing circuit, a small-power wireless transmitter, and a small-power wireless receiver. Therefore, it is difficult to realize this method in regard to cost.

The present invention is made to solve the above-described problems of the conventional apparatus, and it is an object of the present invention to provide a transmission apparatus which hardly become unavailable due to the influence of an existing broadcast wave even when it transmits information by using the frequency band of the standard television broadcasting, and which can be easily realized in regard to cost, and a transmission method using the transmission apparatus.

DISCLOSURE OF THE INVENTION

In order to solve the above-described problems, the invention described in Aspect 1 comprises a master station transmitting video or audio by utilizing a minute-power

wave; a slave station transmitting video or audio by utilizing a minute-power wave; and a relay station placed between the master station and the slave station which are placed apart from each other by a distance longer than the reachable range of the minute-power wave; wherein a transmission signal from the master station includes, in addition to original information such as video or audio, information indicating the address of the slave station, and information indicating a frequency at which the self-station receives a signal from the relay station; the relay station modulates the frequency of the minute-power wave received from the master station to a different frequency and outputs it; the relay station transmits information about a frequency at which the self-station receives a signal from the slave station; and when the slave station recognizes that the transmission signal is a signal directed to the self-station, it modulates the minute-power wave to the freqency specified by the relay station and transmits the video or audio, thereby establishing a transmission path between the master station and the slave station.

This invention enables transmission of video or audio by utilizing a minute-power wave, even when the distance between the master station and the slave station exceeds the reachable range of the minute-power wave.

Further, according to the invention described in aspect 2, in the transmission apparatus described in aspect 1, a standard television signal is used as the transmission signal in the forward path from the master station to the slave station; and a PCM audio signal and the information indicating the address of the slave station and the reception frequency specified by the self-station are superposed on a video signal during the vertical blanking period of the video signal.

This invention enables transmission of video or audio by utilizing a minute-power wave, even when the distance between the master station and the slave station exceeds the reachable range of the minute-power wave.

Further, the invention described in aspect 3 comprises a transmitter having an RF converter which generates a standard television signal; a receiver having an RF tuner which receives the standard television signal; available frequency detection means for detecting frequencies which can be used for video transmission, within the reception band of the RF tuner, in advance of use; detected frequency registration means for registering the detected frequencies, as a communication frequency list, in both of the transmitter and the receiver; and spread spectrum communication means for spreading the power spectrum by changing the frequency within the range of the communication frequency list, and performing spread spectrum communication.

This invention can provide a video transmission apparatus which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention of aspect 4, the transmission apparatus described in aspect 3 includes transmission power control means for automatically changing the transmission power during the communication in accordance with the use frequency band width so as to keep the power density per unit band width constant.

This invention can provide a video transmission apparatus which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect 5, the transmission apparatus described in aspects 3 or 4 includes frequency changing means for changing the frequency during the communication, in synchronization with the synchronous timing of the video signal.

This invention can provide a video transmission apparatus which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect 6, the transmission apparatus described in any of aspects 3 to 5 includes control signal superposition and transmission means for transmitting a control signal by superposing it on the video signal in the blanking period, during the communication.

This invention can provide a video transmission apparatus which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect 7, the transmission apparatus described in any of aspects 3 to 6 includes audio signal superposition and transmission means for subjecting an audio signal to PCM, and transmitting the PCM audio signal by superposing it on the video signal in the blanking period, during the communication.

This invention can provide a video transmission apparatus which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, the invention described in aspect 8 comprises first and second transmission/reception apparatuses each comprising a transmission apparatus described in any of aspects 3 to 7; frequency changing order control means for controlling the frequency changing order, during the communication, in such a manner that the frequency is changed in one direction, from the higher frequency to the lower frequency or from the lower frequency to the higher frequency, within the range of the communication frequency list, and when the frequency reaches the end of the frequency list, it is returned to the beginning of the frequency list; and communication control means for controlling the first and second transmission/reception apparatuses to realize duplex communication, by using a frequency time table in which the first and second transmission/reception apparatuses always use different frequencies.

This invention can provide a video transmission apparatus which realizes duplex video transmission, and reduces the influence of multi-path.

Further, according to the invention described in aspect **9**, the transmission apparatus described in aspect **8** includes communication frequency list update means which uses the previously registered communication frequency list when starting the communication, and uses a second communication frequency list obtained by duplicating the communication frequency list after the communication has been started, and updates the second communication frequency list as desired by exchanging the result of communication, i.e., whether it is good or bad, between the first and second transmission/reception apparatuses.

This invention can provide a video transmission apparatus which realizes duplex video transmission, and solves the influence of multi-path.

Further, according to the invention described in aspect **10**, the transmission apparatus described in any of aspects **3** to **9** includes ID storage means for storing an identification number (hereinafter referred to as an ID) which is given to the transmission apparatus during manufacture; and ID inquiry and registration means for performing mutual inquiry of IDs with another transmission apparatus which is permitted to have communication in advance of use, and registering the ID.

This invention can provide a video transmission apparatus which solves radio interference and prevents interception, in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, according to the invention described in aspect **11**, the transmission apparatus described in aspect **10** includes frequency setting means which always executes the reception mode in advance of the transmission mode to detect the frequency time tables of all other transmission apparatuses which are performing transmission within the same wave area, and performs transmission by using a frequency time table the use frequency of which is always different from those of these other transmission apparatuses; and retransmission means for performing retransmission by using a frequency time table different from the frequency time table when a transmission signal from another apparatus which has requested communication cannot be detected even when a predetermined period of time has passed after starting the transmission mode.

This invention can provide a video transmission apparatus which solves radio interference and prevents interception, in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, according to the invention described in aspect **12**, the transmission apparatus described in aspects **10** or **11** includes output stop means for stopping output of the original information such as audio or video, when the ID which is permitted to have communication cannot be confirmed in the reception mode.

This invention can provide a video transmission apparatus which solves radio interference and prevents interception, in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, the invention described in aspect **13** is a transmission method for mutually transmitting video or audio between a master station and a slave station by utilizing a minute-power wave. In this method, a relay station is placed between the master station and the slave station which are placed apart from each other by a distance longer than the reachable range of the minute-power wave; a transmission signal from the master station includes, in addition to original information such as video or audio, information indicating the address of the slave station, and information indicating a frequency at which the self-station receives a signal from the relay station; the relay station modulates the frequency of the minute-power wave received from the master station to a different frequency and outputs it; the relay station transmits information about a frequency at which the self-station receives a signal from the slave station; and when the slave station recognizes that the transmission signal is a signal directed to the self-station, it modulates the minute-power wave to the frequency specified by the relay station and transmits the video or audio, thereby establishing a transmission path between the master station and the slave station.

This invention enables transmission of video or audio by utilizing a minute-power wave, even when the distance between the master station and the slave station exceeds the reachable range of the minute-power wave.

Further, according to the invention described in aspect **14**, in the transmission method described in aspect **13**, a standard television signal is used as the transmission signal in the forward path from the master station to the slave station; and a PCM audio signal and the information indicating the destination station and the reception frequency specified by the self-station are superposed on a video signal during the vertical blanking period of the video signal.

This invention enables transmission of video or audio by utilizing a minute-power wave, even when the distance between the master station and the slave station exceeds the reachable range of the minute-power wave.

Further, the invention described in aspect **15** is a transmission method for performing transmission between a transmitter having an RF converter which generates a standard television signal, and a receiver having an RF tuner which receives the standard television signal. In this method, in advance of use, frequencies which can be used for video transmission are detected within the reception band of the RF tuner; the detected frequencies are registered, as a communication frequency list, in both of the transmitter and the receiver; and the power spectrum is spread by changing the frequency within the range of the communication frequency list, thereby performing spread spectrum communication.

This invention can provide a video transmission method which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect **16**, in the transmission method described in aspect **15**, the transmission power during the communication is automatically changed in accordance with the use frequency band width so as to keep the power density per unit band width constant.

This invention can provide a video transmission method which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect **17**, in the transmission method described in aspects **15** or **16**, the

frequency during the communication is changed in synchronization with the synchronous timing of the video signal.

This invention can provide a video transmission method which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect **18**, in the transmission method described in any of aspects **15** to **17**, during the communication, a control signal is transmitted by superposing it on the video signal in the blanking period.

This invention can provide a video transmission method which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables highly efficient performance, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, according to the invention described in aspect **19**, in the transmission method described in any of aspects **15** to **18**, during the communication, an audio signal is subjected to PCM, and the PCM audio signal is transmitted by superposing it on the video signal in the blanking period.

This invention can provide a video transmission method which has the function of receiving NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission, realizes a longer communication distance than that in the case of using a single frequency, and is able to coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, the invention described in aspect **20** is a transmission method, wherein each of first and second transmission/reception apparatuses performs a transmission method described in any of aspects **15** to **19**; during the communication, the frequency changing order is controlled in such a manner that the frequency is changed in one direction, from the higher frequency to the lower frequency or from the lower frequency to the higher frequency, within the range of the communication frequency list, and when the frequency reaches the end of the frequency list, it is returned to the beginning of the frequency list; and the first and second transmission/reception apparatuses are controlled to realize duplex communication, by using a frequency time table in which the first and second transmission/reception apparatuses always use different frequencies.

This invention provides a video transmission method which realizes duplex video communication and reduces the influence of multi-path.

Further, according to the invention described in aspect **21**, in the transmission method described in aspect **20**, the previously registered communication frequency list is used when starting the communication and, after the communication has been started, a second communication frequency list obtained by duplicating the communication frequency list is used, and the second communication frequency list is updated as desired by exchanging the result of communication, i.e., whether it is good or bad, between the first and second transmission/reception apparatuses.

This invention provides a video transmission method which realizes duplex video communication and solves the influence of multi-path.

Further, according to the invention described in aspect **22**, in the transmission method described in any of aspects **15** to **21**, an identification number (hereinafter referred to as an ID) given to the transmission apparatus during manufacture is stored; and in advance of use, mutual inquiry of IDs is performed with another transmission apparatus which is permitted to have communication, and the ID is registered.

This invention can provide a video transmission method which solves radio interference and prevents interception, in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, according to the invention described in aspect **23**, in the transmission method described in aspect **22**, the reception mode is always performed in advance of the transmission mode to detect the frequency time tables of all other transmission apparatuses which are performing transmission within the same wave area, and transmission is performed by using a frequency time table the use frequency of which is always different from those of these other transmission apparatuses; and when a transmission signal from another apparatus which has requested communication cannot be detected even when a predetermined period of time has passed after starting the transmission mode, retransmission is performed by using a frequency time table different from the frequency time table.

This invention can provide a video transmission method which solves radio interference and prevents interception, in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, according to the invention described in aspect **24**, in the transmission method described in aspects **22** or **23**, when the ID which is permitted to have communication cannot be confirmed in the reception mode, the original information such as audio or video is not output.

This invention can provide a video transmission method which solves radio interference and prevents interception, in a multiple dwelling house in which the use wave areas may overlap uncertainly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**(*a*) is a diagram illustrating the structure of a transmission apparatus according to a first embodiment of the present invention.

FIG. **1**(*b*) is a block diagram illustrating the respective stations of the transmission apparatus.

FIG. **2** is a diagram for explaining the operation with respect to the manner of establishing a transmission path in the transmission apparatus.

FIG. **3** is a diagram illustrating the waveform of a modulation signal in the transmission apparatus.

FIG. **4** is a block diagram for realizing simplex communication of a video transmission apparatus according to a second embodiment of the present invention.

FIG. **5** is a block diagram for realizing duplex communication of video transmission apparatuses according to third and fourth embodiments of the present invention.

FIG. **6** is a diagram for explaining the signal power of the video transmission apparatuses according to the second, third, and fourth embodiments of the present invention.

FIG. **7** is a diagram for explaining the reception level of the video transmission apparatuses according to the second, third, and fourth embodiments of the present invention.

FIG. **8** is a diagram illustrating received video of the video transmission apparatuses according to the second and third embodiments of the present invention.

FIG. 9 is a diagram illustrating a video signal of the video transmission apparatuses according to the second and third embodiments of the present invention.

FIG. 10 is a diagram illustrating overlapping of use wave areas of a video transmission apparatus according to a fourth embodiment of the present invention.

FIG. 11 is a block diagram illustrating the structure of the conventional video transmission apparatus.

BEST MODE TO EXECUTE THE INVENTION

Embodiment 1

In a first embodiment of the invention, a relay station for relaying transmission of a video signal or an audio signal is placed between a master station and a slave station, such as a parent unit and a child unit, which are placed apart by a distance longer than the reachable range of a minute-power wave, thereby establishing a transmission path by the minute-power wave.

This first embodiment corresponds to the inventions which are described in aspects **1** and **2** and aspects **13** and **14** of this application.

Hereinafter, the first embodiment of the present invention will be described with reference to the drawings. In this first embodiment, a front-door visual phone is employed as an example. That is, in this transmission apparatus, visitor's image and speech taken by a child unit at the front door are transmitted to a parent unit in a room, and only a speech is transmitted from the parent unit, thereby performing mutual communication.

FIG. **1**(*a*) is a diagram illustrating the structure of the transmission apparatus according to the first embodiment of the present invention, and FIG. **1**(*b*) is a block diagram for explaining the circuit structure of each station in the transmission apparatus.

In FIG. **1**(*a*), numeral **1** denotes a master station as a child unit placed at the front door, and numeral **4** denotes a terminal connected to the master station **1**, which includes a camera for taking the image of the visitor, and a mike and a speaker for a conversation with the resident in a room. Numeral **2** denotes a relay station. Since the relay station **2** is placed in a passage or the like, it is not provided with a terminal for inputting and outputting the image and the speech. Numeral **3** denotes a slave station as a parent unit placed in a room, and numeral **5** denotes a terminal connected to the slave station **3**, which includes a monitor for displaying the visitor, and a mike and a speaker for a conversation between the visitor and the resident in the room.

Further, numeral **6** denotes the reachable range of the minute-power wave from the master station **1**, and the relay station **2** is arranged within this range. Numeral **7** denotes the reachable range of the minute-power wave output from the relay station **2**, and the master station **1** and the slave station **3** are arranged within this range. Numeral **8** denotes the reachable range of the minute-power wave output from the slave station, and the relay station **2** is arranged within this range.

Next, the operation will be described. The respective stations **1**, **2**, and **3** perform transmission and reception at different frequencies. To be specific, the master station **1** transmits a signal for calling the slave station **3**, from the terminal **4**, at a frequency f**1**. At this time, the master station **1** specifies that the reception frequency of the self-station is f**0**. The relay station **2** modulates the received calling signal to a frequency f**2** which is different from f**1**, and outputs it. At this time, the relay station **2** adds information indicating that the reception frequency of the self-station is f**1**. Further, the slave station **3** receives the calling signal of the frequency f**2** and outputs it to the terminal **5**.

Then, the slave station **3** outputs a response signal from the terminal **5** at the frequency f**1** specified by the relay station **2**. When the relay station **2** receives the response signal of the reception frequency specified by the self-station, the relay station **2** modulates this to the frequency specified by the master station **1** and outputs it. When this signal is received by the master station **1**, a transmission path is established.

FIG. **3** shows an example of a modulation signal transmitted from the master station **1** as a child unit to the slave station **3** as a parent unit. This is obtained by superposing a PCM audio signal **303** and a system control signal **304** on a video signal used in a standard television, in a horizontal scanning period **302** in a vertical blanking period **301** of an odd field of the video signal. The PCM audio signal **303** includes audio information from the terminal **4** of the master station **1**. The system control signal **304** includes destination information indicating that the station **3** having the terminal **5** is the slave station, and information about the reception frequency of the self-station.

FIG. **1**(*b*) is a block diagram illustrating the circuit of each station. A body **1101** of each station comprises a station selection/video audio demodulation circuit **1102** for demodulating a video or audio signal supplied from another station, and specifying the reception frequency of the self-station; a high-frequency video modulation circuit for modulating a video signal in which an audio signal and a system control signal are superposed; a high-frequency audio modulation circuit for modulating an audio signal; a control circuit **1105** for controlling frequency change in each circuit, and controlling exchange of a video signal, an audio signal, and a control signal between the body **1101** of each station and a terminal **1107** connected to the body; and a transmission/reception antenna **1106**. **1107** denotes a terminal for outputting a video signal, an audio signal, and a control signal for controlling the apparatus, to each station body **1101** and, conversely, receiving a video signal, an audio signal, and a control signal from each station body **1101**, but the relay station **2** is not provided with this terminal **1107** as described above.

Hereinafter, the manner of successively extending the transmission path to be established will be described in detail by using FIG. **2**.

Initially, in the stage where the master station **1** does not emit a wave, each station operates the station selection/video and audio demodulation circuit **1102**. Each station monitors a predetermined frequency range while scanning as to whether a wave is emitted from another station or not. At the same time, the master station **1** observes as to whether a transmission request is output from the terminal **4** connected thereto or not.

In the first stage shown in FIG. **2**(*a*), when video and audio signals and a transmission request from the terminal **4** are input to the master station **1**, the master station **1** transmits the high-frequency signal of the frequency f**1** which is modulated by the modulation signal shown in FIG. **3**. As described above, in this signal, information indicating the slave station **3** and information indicating the reception frequency of the self-station is f**0** are added (superposed). As for these frequencies f**1** and f**0**, frequencies which are not used by other radio apparatuses and have less noises are

selected in advance, according to the result of the frequency monitoring which has been performed until receiving the transmission request.

The reason why the audio information from the terminal **4** is superposed as a PCM audio signal in the video signal for transmission is because usually the frequency for audio transmission used in a standard television is used for return transmission of the relay station **2**.

Therefore, in the forward path, the frequency for the audio transmission is transmitted without being modulated.

On the other hand, the relay station **2** which has monitored as to whether a wave is emitted from another station or not, receives the wave of the frequency f1 transmitted from the master station **1** because the relay station **2** is placed within the reachable range of the wave from the master station **1**. At this time, the slave station **3** does not receive the wave because it is not within the reachable range of the wave from the master station **1**.

Next, in the second stage shown in FIG. **2**(*b*), the relay station **2** knows, as the result of demodulating the received wave, that the destination station is not the self-station. So, the relay station **2** adds information indicating that the reception frequency of the self-station is f1 to the system control signal on the demodulated video signal to obtain a modulation signal. Then, the relay station **2** modulates this modulation signal at the frequency f2 and transmits it. This transmission frequency f2 is selected according to the result of monitoring the frequency.

In addition, the relay station **2** knows that the master station **1** uses the frequency f0 for reception and so this frequency f0 must be used for the return path. So, the relay station **2** modulates the demodulated audio signal obtained by reception to the frequency f0 and transmits it, thereby establishing the return path.

On the other hand, the slave station **3** which has monitored as to whether a wave is emitted from another station or not, receives the wave of the frequency f2 transmitted from the relay station **2** because it is placed within the reachable range of the wave from the relay station **2**.

In the third stage shown in FIG. **2**(*c*), the slave station **3** knows, as the result of demodulating the received signal, that the destination is the terminal **5** connected to the self-station. So, the slave station **3** demodulates the audio from the PCM audio signal on the received video signal, and extracts the control signal of the terminal **5** from the system control signal, thereby separating these signals from the video signal and, thereafter, outputs these control signal, video signal, and audio signal to the terminal **5**.

Furthermore, the slave station **3** knows that the relay station **2** is in the receiving state at the frequency f1 and so the frequency f1 must be used for the return path. So, the slave station **3** modulates the response signal indicating that video transmission has been normally performed, by using an audio outside the audible range, and superposes the audio signal from the terminal **5** on this audio signal outside the audible range to obtain a modulation signal. Then, the slave station **3** modulates this modulation signal at the frequency f1 and transmits it.

Since the relay station **2** receiving the wave of the frequency f1 has already established the return path at the frequency f0, the response signal and the audio signal from the slave station **3** can be immediately transmitted to the master station **1** at the frequency f0. Then, the master station **1** separates the response signal and the audio signal from the wave supplied from the relay station **2**, whereby the master station **1** continues monitoring, from the response signal, that the video transmission is normally carried on, and receives the audio signal from the terminal **5**. As the result, bidirectional audio transmission is realized.

As described above, according to the first embodiment of the invention, the signal to be transmitted from the master station includes, besides video and audio, information indicating the destination station to which the signal is directed, and information indicating the frequency at which the self-station receives a signal from the relay station. The relay station modulates the signal from the master station to a frequency different from the reception frequency and outputs it. At this time, the relay station adds information indicating the frequency at which the self-station receives the signal from the slave station, to the signal to be transmitted. When the slave station recognizes that the transmission signal is a signal directed to the self-station, it modulates the video or audio signal to the frequency specified by the relay station, and transmits the signal. The relay station transmits this signal successively to the master station, whereby the transmission path between the master station and the slave station can be established even when the distance between the master station **1** as a child unit and the slave station **3** as a parent unit exceeds the reachable range of the minute-power wave. Thereby, half duplex transmission is realized for the video while full duplex transmission is realized for the audio, and transmission of the system control signal is realized.

While in this first embodiment the transmission apparatus includes only one relay station, when the number of relay stations is increased and the relay stations are successively placed within the reachable range of the minute-power wave, the distance between the master station and the slave station can be further increased.

In this first embodiment, one-directional transmission from the child unit to the parent unit is described with respect to the video signal. However, since the forward path and the return path are inverted by interchanging the use frequency of the high-frequency video modulation circuit and the use frequency of the high-frequency audio modulation circuit, when the interchange of the use frequencies is performed at high speed, bidirectional simultaneous transmission of video can be performed apparently.

Further, while in this first embodiment the relay station is provided with no terminal, when the number of relay stations is increased and the relay stations are provided with terminals, the master station and the slave station are not fixed, and a transmission path can be established between arbitrary stations.

Further, while in this first embodiment a front-door visual phone is taken as an example to explain the terminal, the terminal can be applied to a video camera, a VTR, a portable visual phone, and the like.

Furthermore, while in this first embodiment a digitized audio signal is subjected to PCM, other compressive coding methods may be used.

Embodiment 2

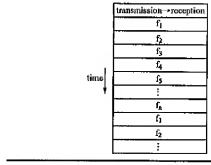
In this second embodiment, information can be transmitted without being affected by multi-path even when using a minute-power wave, by performing spread frequency communication.

Hereinafter, the second embodiment of the invention will be described by using FIGS. **4**, **6**, **7**, **8**, and **9** and table 1. This second embodiment corresponds to the inventions described in aspects **3** to **7** and aspects **15** to **19** of this application.

FIG. **4** illustrates the structure of a transmission apparatus according to the second embodiment of the invention. Fur-

ther, FIG. 6 illustrates the signal power according to the second embodiment of the invention. Further, FIG. 7 illustrates the reception level according to the second embodiment of the invention. Further, FIG. 8 illustrates the video transmission state according to the second embodiment of the invention in comparison with that of the conventional example. Further, FIG. 9 illustrates a video signal according to the second embodiment of the invention. Further, table 1 shows the frequency changing order according to the second embodiment of the invention.

TABLE 1



In FIG. 4, numeral **101** denotes a transmission apparatus performing transmission; numeral **115** denotes a transmission antenna which transmits a wave; numeral **102** denotes an RF converter which generates a standard television signal; numeral **111** denotes a voltage controlled oscillator which oscillates at a frequency according to a control voltage; numeral **112** denotes a compositor which composites two input signals by addition; numeral **113** denotes a mixer which composites two input signals by multiplication; numeral **114** denotes a variable attenuator which attenuates an input according to a control signal; numeral **103** denotes a communication terminal which receives an input from the outside; numeral **104** denotes an external apparatus connecting terminal for connecting an external apparatus; numeral **105** denotes an audio input terminal for inputting an audio signal; numeral **106** denotes a video input terminal for inputting a video signal; numeral **109** denotes an AD converter which converts an analog signal to a digital signal; numeral **110** denotes a comparator which compares an input signal with a set value; numeral **107** denotes a control circuit which controls the transmission apparatus **101**; numeral **108** denotes a storage circuit which is used by the control circuit **107** to store information; and numeral **116** denotes a register button which is used for registering the setting of this transmission apparatus **101**.

Further, numeral **117** denotes a receiving apparatus which performs reception; numeral **132** denotes a receiving antenna which receives a wave; numeral **118** denotes an RF tuner which receives a standard television signal; numeral **128** denotes a voltage controlled oscillator which oscillates at a frequency according to a control voltage; numeral **129** denotes a mixer which composites two input signals by multiplication; numeral **130** denotes an AGC circuit which automatically controls the gain of a signal; numeral **131** denotes an intermediate frequency processing circuit which processes an intermediate frequency signal; numeral **123** denotes a control circuit which controls the receiving apparatus **117**; numeral **124** denotes a storage circuit which is used by the control circuit **123** to store information; numeral **125** denotes a DA converter which converts a digital signal to an analog signal; numeral **126** denotes a comparator which compares an input signal with a set value; numeral **127** denotes an audio selector switch which outputs one of two kinds of audio signals; numeral **133** denotes a detection button used for instructing detection as to whether a signal is transmitted to this receiving apparatus **117** or not; numeral **119** denotes a communication terminal for outputting a signal to the outside; numeral **120** denotes an external apparatus connecting terminal for connecting external apparatus; numeral **121** denotes a video output terminal for outputting a video signal; and numeral **122** denotes an audio output terminal for outputting an audio signal.

Further, numeral **500** denotes an available frequency detection means described in aspect **3**. This available frequency detection means **500** detects frequencies which can be used for video transmission within the reception band of the RF tuner, in advance of use, and this means is composed of the RF tuner **118**, the control circuit **123**, the storage circuit **124**, the comparator **126**, and the detection button **133**.

Further, numeral **501** denotes a frequency registration means described in aspect **3**. This frequency registration means **501** registers the detected frequencies as a communication frequency list in both of the transmission and receiving apparatuses, and this means is composed of the communication terminals **103** and **119**, the control circuits **107** and **123**, the storage circuits **108** and **124**, and the registration button **116**.

Further, numeral **502** denotes a spread spectrum communication means described in aspect **3**. This spread spectrum communication means **502** spreads the power spectrum by rapidly changing the frequency within the range of the communication frequency list, and this means is composed of the control circuits **107** and **123**, the storage circuits **108** and **124**, the RF converter **102**, and the RF tuner **118**.

Further, numeral **503** denotes a transmission power control means described in aspect **4**. This transmission power control means **503** automatically changes the transmission power according to the use frequency band width so as to keep the power density per unit band width constant, and this means is composed of the control circuit **107**, the storage circuit **108**, and the variable attenuator **114**.

Further, numeral **504** denotes a frequency changing means described in aspect **5**. This frequency changing means **504** changes the frequency at the synchronous timing of video signal, and this means is composed of the video input terminal **106**, the comparators **110** and **126**, and the control circuits **107** and **123**.

Further, numeral **505** denotes a control signal superposition and transmission means described in aspect **6**. This control signal superposition and transmission means **505** superposes the control signal on the video signal in the blanking period and transmits the video signal, and this means is composed of the external apparatus connecting terminals **104** and **120**, the control circuits **107** and **123**, the comparators **110** and **126**, and the compositor **112**.

Further, numeral **506** denotes an audio signal superposition and transmission means described in aspect **7**. This audio signal superposition and transmission means **506** subjects the audio signal to PCM, superposes the audio signal on the video signal in the blanking period, and transmits the video signal. This means is composed of the audio input terminal **105**, the output terminal **122**, the AD converter **109**, the DA converter **125**, the control circuits **107** and **123**, the comparators **110** and **126**, the compositor **112**, and the audio changing switch **127**.

Here, the frequencies which are available for video transmission are the frequency bands designated by **307** in FIG. **6**. These frequencies **307** available for video transmission have no broadcast wave **305**, no external noise, and no image reception of a strong broadcast wave.

Next, the operation will be described. In FIG. **4**, when the operator pushes the detection button **133** of the receiving apparatus **117**, the control circuit **123** starts operation. The control circuit **123** controls the RF tuner **118** so that the tuner **118** receives all of the frequencies in the reception band **303**.

The video output from the RF tuner **118** is input to the comparator **126** to be compared with a predetermined detection value. The result of the comparison is input to the control circuit **123**. Based on the result of the comparison, the control circuit **123** detects frequencies having no video synchronous signal due to a broadcast wave or an image wave of the broadcast wave and no random signal due to external noise, as frequencies available for video transmission, and stores these frequencies as a list in the storage circuit **124**.

In the case where, in advance of use, the transmission apparatus **101** and the receiving apparatus **117** are connected by a cable through the communication terminals **103** and **119** and then the operator pushes the registration button **116** of the transmission apparatus **101**, the control circuit **107** of the transmission apparatus **101** requests the control circuit **123** of the receiving apparatus **117** to send the list of the frequencies available for video transmission, through the communication terminal **103**.

The control circuit **123** of the receiving apparatus **117** reads the list of the frequencies available for video transmission which are stored in the storage circuit **124**, and stores it again in this storage circuit **124** as a communication frequency list, and then transmits it to the transmission apparatus **101** through the communication terminals **119** and **103**.

In the transmission apparatus **101**, the list of the frequencies available for video transmission which have been transmitted from the receiving apparatus **117** is stored in the storage circuit **108** as a communication frequency list.

Turning to FIG. **4**, when a video transmission request signal from an external apparatus is input to the external apparatus control terminal **104** of the transmission apparatus **101** and further a video signal from an external apparatus is input to the video input terminal **106**, the control circuit **107** of the transmission apparatus **101** reads the communication frequency list which is stored in the storage circuit **108**. In parallel with this, the control circuit **107** sets the attenuation of the variable attenuator **114** to the maximum and, thereafter, operates the RF converter **102**.

Further, the control circuit **107** spreads the power spectrum by rapidly changing the RF frequency of the RF converter **102**, within the range of the communication frequency list which has been read, in accordance with the frequency changing order shown in table **1** and, thereafter, reduces the attenuation of the variable attenuator **114** to start transmission.

The frequency changing order shown in table **1** is an example which is predetermined between the transmission apparatus **101** and the receiving apparatus **117**.

Further, the communication frequency is changed according to the timing of the horizontal synchronous signal or vertical synchronous signal of the video signal input through the video input terminal **106**. At this time, the synchronous signal to be used is extracted from the video signal by the comparator **110**.

In order to prevent influences on other radio apparatuses and utilize the wave effectively, it is necessary to set the RF power density per unit band width, which is transmitted from the transmission apparatus **101**, to a level lower than the minute-power wave level **304** shown in FIG. **6**. Therefore, the control circuit **107** obtains the band width of the use frequency and the diffusion coefficient of the power spectrum from the communication frequency list, and thereby controls the attenuation of the variable attenuator **114** so that the RF power density per unit band width is kept constant.

On the other hand, in FIG. **4**, when a video reception request signal from an external apparatus is input to the external apparatus control terminal **120** of the receiving apparatus **117**, the control circuit **123** of the receiving apparatus **117** reads the communication frequency list stored in the storage circuit **124** and operates the RF tuner **118**.

Thereby, the control circuit **123** rapidly changes the receiving frequency of the RF tuner **118**, and receives the RF signal from the transmission apparatus **101**. The frequency change is performed in the frequency changing order shown in table **1**, within the communication frequency list read by the control circuit **123**. Further, as the frequency change timing, the pseudo synchronous timing generated inside the control circuit **123** is used.

During the period immediately after the receiving apparatus **117** has started reception, the synchronous timing of the video signal at the transmitting end and the pseudo synchronous timing at the receiving end do not necessarily coincide with each other. Further, the transmission frequency and the receiving frequency do not necessarily temporally coincide with each other. Therefore, no signal appears in the video output of the RF tuner of the receiving apparatus **117** nor in the output of the comparator **126**.

Accordingly, the control circuit **123** of the receiving apparatus **117** tries to detect the transmission signal, by successively changing the pseudo synchronous timing and the start time of the time table of the reception frequency, while monitoring the output of the comparator **12**.

Since the synchronous timing of the video signal at the transmitting end and the time assignment period of the transmission frequency are constant, the receiving end succeeds in detecting the transmission signal after predetermined trials.

When detection of the transmission signal has succeeded, the control circuit **123** of the receiving apparatus **117** changes the synchronous timing of the received video signal extracted by the comparator **126** to the pseudo synchronous timing.

Generally, the reception level of radio transmission using a wide band is affected by the multi-path and the frequency characteristics of the transmission/receiving antenna. When being affected by the frequency characteristics of the multi-path and the transmission/receiving antenna, the reception level changes significantly as shown by **406** in FIG. **7**. At a frequency the reception level of which is lower than the communication threshold level **407**, the video signal cannot be reproduced. Therefore, in the conventional method using a single frequency, when the position of the transmission apparatus or the receiving apparatus changes during it is used or when the position of a peripheral reflecting object which reflects the wave changes, there occurs a condition where no wave can be received as shown in FIG. **8**(*a*), whereby the usability is significantly degraded.

In contrast with this, according to the second embodiment of the invention, since only a portion of the video signal cannot be reproduced as shown in FIG. **8**(*b*), the reception status is improved.

Generally, in order to prevent influences on other radio apparatuses and effectively use the wave, in a radio transmission apparatus using a minute-power wave, an upper limit is set for the electric field strength in a position apart from the apparatus by a predetermined distance. The upper limit depends on the degree of influence on another radio apparatus which uses the same frequency band, but the inspection and measurement method is decided on the basis of the system of the radio apparatus which will be influenced. Control of the electric field strength in a position apart by a predetermined distance is realized by controlling the transmission power in the case of using a transmission antenna which is fixed on the apparatus.

Further, although the mutual influence between the radio apparatuses of the system using a single frequency and the mutual influence between the radio apparatuses of the system using a spread spectrum are great, the mutual influence between these systems is small. This is applicable to the mutual influence between the transmission apparatus of the present invention which uses the frequency band of the standard television broadcasting and spreads the spectrum for transmission, and existing another radio apparatus, that is, a television receiver which uses a single frequency.

For the reasons described above, according to the transmission apparatus of this embodiment which uses the frequency band of the standard television broadcasting and spreads the spectrum for transmission, it is possible to realize transmission at a higher output power than that of the conventional system using a single frequency. Since the reception power increases with the output power, the transmission distance can be increased.

Further, in the transmission apparatus according to this second embodiment, the frequencies available for video transmission are detected and registered in advance of use. Therefore, in the future, even when digital television broadcasting or mobile communication equipment will use the same frequency band, the transmission apparatus of this embodiment can coexist with these systems.

In the state where the video signal is transmitted from the transmission apparatus **101**, when a control signal for controlling the external apparatus which is connected to the receiving apparatus **117** is input to the external apparatus connecting terminal **104** of the transmission apparatus **101**, the control circuit **107** of the transmission apparatus **101** outputs the received control signal to the RF converter **102** at the timing of superposing it on the video signal in the blanking period.

The control signal is superposed on the part of data **605** shown in FIG. **9** by the compositor **112** in the RF converter **102**, and then transmitted to the receiving apparatus **117**.

In the receiving apparatus **117** which has received the video signal in which the control signal is superposed, the comparator **126** extracts the control signal from the video signal and outputs it to the external apparatus connecting terminal **120**.

Thereby, the external apparatus connected to the receiving apparatus **117** can be controlled by the external apparatus connected to the transmission apparatus **101**, resulting in a high performance video transmission apparatus.

Further, in the state where the video signal is transmitted from the transmission apparatus **101**, when an audio signal is input to the audio input terminal **105**, the audio signal is AD converted by the AD converter **109** and then input to the control circuit **107**. When the AD-converted audio signal is input, the control circuit **107** subjects the received audio signal to PCM, and outputs the PCM signal to the RF converter **102** at the timing of superposing it on the video signal in the blanking period shown in FIG. **9**.

The PCM signal is superposed on the part of data **605** shown in FIG. **9** by the compositor **112** in the RF converter **102** to be transmitted to the receiving apparatus **117**.

In the receiving apparatus **117** which has received the video signal on which the PCM signal is superposed, the PCM signal is extracted from the video signal by the comparator **126** and output to the control circuit **123**. The control circuit **123** outputs the PCM signal to the DA converter **125**, and switches the audio switch circuit **127** to the PCM audio use state.

In the DA converter **125**, the PCM signal is converted to an audio signal to be output to the audio output terminal **122**.

Thereby, high-definition audio transmission having no audio noise due to communication frequency change is realized.

As described above, in the transmission apparatus according to the second embodiment, in advance of use, the frequencies which are available for video transmission are detected within the reception band of the RF tuner of the receiving apparatus. The detected frequencies are registered, as a communication frequency list, in both of the transmission apparatus and the receiving apparatus, and the frequency is rapidly changed within the range of the communication frequency list to spread the power spectrum for communication. Therefore, inexpensive and simplex, i.e., one-direction, video transmission also having a function of receiving television broadcasting, can be realized. Further, the influence of the multi-path can be reduced, and it is not influenced by a strong existing broadcast wave. Moreover, a communication distance longer than that of the system using a single frequency is achieved and, therefore, it is possible to realize a video transmission apparatus which can coexist with digital television broadcasting or mobile communication equipment which will use the same frequency band in the future.

Further, since the transmission power is automatically changed according to the use frequency band width so as to keep the power density per unit band width constant, it is possible to realize a video transmission apparatus which operates at a minute-power level which does not interfere with reception of the existing radio receiving apparatus even when the use frequency band width changes.

Further, since the frequency is changed at the synchronous timing of the video signal, disturbance of the video signal due to the frequency change is reduced, resulting in a video transmission apparatus with improved image quality.

Furthermore, since the control signal is superposed on the video signal in the blanking period to be transmitted, it is possible to realize a high performance video transmission apparatus which can control the operation of the receiving apparatus from the transmission apparatus.

Moreover, since the audio signal is subjected to PCM and the PCM audio signal is superposed on the video signal in the blanking period to be transmitted, noise in the audio signal due to frequency change is removed, resulting in a video transmission apparatus of improved sound quality.

Accordingly, the transmission apparatus of this second embodiment has the function of receiving the NTSC system standard television broadcasting, reduces the influence of multi-path, enables high-definition audio transmission and highly efficient performance, and realizes a longer communication distance than that in the case of using a single frequency. Further, in the future, even when digital television broadcasting or mobile communication equipment will use the same frequency band, the transmission apparatus can

coexist with them and, furthermore, the transmission apparatus can be applied to a VTR movie apparatus or the like in which a camera is wireless-detachable from a recording unit body.

Further, while in this second embodiment the digitized audio signal is subjected to PCM, other compressive coding methods may be employed.

Further, while in this second embodiment the NTSC system is employed as a standard television signal, the PAL system or the SECAM system may be employed.

Embodiment 3

In this third embodiment, two pieces of transmission/reception apparatuses, each having a transmission apparatus and a receiving apparatus according to the second embodiment, are provided.

Hereinafter, the third embodiment of the present invention will be described by using FIGS. **5**, **6**, **7**, **8** and **8**, and table **2**.

This third embodiment corresponds to the inventions described in aspects **8** and **9** and aspects **20** and **21** of this application.

FIG. **5** shows the structure of a transmission apparatus according to the third embodiment of the invention. FIG. **6** shows the signal power according to the third embodiment of the invention. FIG. **7** shows the reception level according to the third embodiment of the invention. FIG. **8** shows the transmission status according to the third embodiment of the invention in comparison with that of the conventional example. FIG. **9** shows an image signal according to the third embodiment of the invention. Table **2** shows the frequency changing order and the frequency time table according to the third embodiment of the invention.

TABLE 2

	first→second	second→first
	f_1	f_{n-1}
	f_2	f_n
	f_3	f_1
	f_4	f_2
time ↓	f_5	f_3
	⋮	⋮
	f_n	f_{n-2}
	f_1	f_{n-1}
	f_2	f_n
	⋮	⋮

In FIG. **5**, **201**A and **201**B denote transmission/reception apparatuses each performing transmission and reception; **202**A and **202**B denote RF converters each generating a standard television signal; **215**A and **215**B denote voltage-controlled oscillators each oscillating at a frequency according to a control voltage; **216**A and **216**B denote compositors each compositing two input signals by addition; **217**A and **217**B denote mixers each compositing two input signals by multiplication; **218**A and **218**B denote variable attenuators each compositing input signals according to a control signal; **219**A and **219**B denote transmission/reception antennae each transmitting and receiving a wave; **207**A and **207**B denote communication terminals each receiving an input signal from the outside and outputting it to the outside; **208**A and **208**B denote external apparatus connecting terminals each connecting the transmission/reception apparatus with an external apparatus; **205**A and **205**B denote audio input terminals each receiving an audio signal; **204**A and **204**B denote video input terminals each receiving a video signal; **213**A and **213**B denote AD converters each converting an analog signal to a digital signal; **214**A and **214**B denote comparators each comparing an input signal with a set value; **211**A and **211**B denote control circuits for controlling the transmission/reception apparatuses **201**A and **201**B, respectively; **212**A and **212**B denote storage circuits used by the control circuits **211**A and **211**B to store information, respectively; **206**A and **206**B denote detection/registration buttons for registering settings of the transmission/reception apparatuses **201**A and **201**B and for instructing detection as to whether a signal is transmitted to the transmission/reception apparatuses **201**A and **201**B or not, respectively; **203**A and **203**B denote RF tuners each receiving a standard television signal; **220**A and **220**B denote voltage controlled oscillators each oscillating at a frequency according to a control signal; **221**A and **221**B denote mixers each compositing two inputs by multiplication; **222**A and **222**B denote AGC circuits each controlling the gain of the signal; **223**A and **223**B denote intermediate-frequency processing circuits each processing an intermediate-frequency signal; numeral **224**A and **224**B denote DA converters each converting a digital signal to an analog signal; **225**A and **225**B denote comparators each comparing an input signal with a set value; **226**A and **226**B denotes audio selector switches each outputting one of two kinds of audio signals; **209**A and **209**B denote video output terminals each outputting a video signal; and **210**A and **210**B denote audio output terminals each outputting an audio signal.

In FIG. **5**, **201**A and **201**B denote a first transmission/reception apparatus and a second transmission/reception apparatus which are described in aspect **8**, respectively.

Further, **510** denotes a frequency changing order control means described in aspect **8**. This frequency changing order control means **510** controls the frequency changing order so that the frequency is changed in one direction from the higher frequency to the lower frequency or from the lower frequency to the higher frequency, within the range of the communication frequency list and, when reaching the end of the frequency list, the frequency is returned to the beginning of the frequency list. This means **510** is composed of the control circuit **211**A and the storage circuit **212**A.

Further, **511** denotes a communication control means described in aspect **8**. This communication control means **511** controls communication so that duplex, i.e., bidirectional, communication is carried out, by using a frequency time table in which the first and second transmission/reception apparatuses always use different frequencies. This means **511** is composed of the control circuit **211**A and the storage circuit **212**A.

Further, **512** denotes a communication frequency list update means described in aspect **9**. This communication frequency list update means **512** uses the registered communication frequency list when starting communication and, after the communication has once started, it uses a second communication frequency list which is obtained by duplicating the communication frequency list. The second communication frequency list is used for exchanging information about the result of communication, i.e., good or bad, between the two pieces of transmission/reception apparatuses. This means **512** is composed of the control circuit **211**A, the storage circuit **212**A, the comparators **214**A and **225**A, and the compositor **216**A.

Each of the first and second transmission/reception apparatuses **201**A and **201**B is provided with the units and means constituting the transmission apparatus and the receiving apparatus shown in FIG. **5**.

Next, the operation will be described.

In FIG. **5**, when the operator pushes the detection/registration button **206**A of the first transmission/reception apparatus **201**A, the control circuit **211**A starts the operation. Thereby, the control circuit **211**A controls the RF tuner **203**A so that it receives all of the frequencies within the reception band **303** shown in FIG. **3**.

The video output from the RF tuner **203**A is input to the comparator **225**A. The result of comparison is input to the control circuit **211**A, and the control circuit **211**A detects frequencies having no video synchronous signal due to a broadcast wave or an image wave of the broadcast wave and no random signal due to external noise, as frequencies available for video transmission. These frequencies are stored as a list in the storage circuit **212**A.

The second transmission/reception apparatus **201**B is identical in structure to the first transmission/reception apparatus **201**A, and if performs the series of operations after the detection/registration button **206**B is pushed, like the above-described first transmission/reception apparatus **201**A.

The first and second transmission/reception apparatuses are not necessarily used in the same position or direction. Therefore, usually the directions of the antennae **219**A and **219**B are different from the broadcast wave arrival direction and, therefore, their lists detected and stored as frequencies available for video transmission are different from each other.

Next, after the first transmission/reception apparatus **201**A and the second transmission/reception apparatus **201**B are connected by a cable through the communication terminals **207**A and **207**B, when one of the detection/registration buttons **206**A and **206**B is pushed, the control circuit of one of the transmission/reception apparatuses requests the control circuit of the other transmission/reception apparatus to send the list of frequencies available for video transmission, through the communication terminals.

Hereinafter, the operation will be described on the assumption that the detection/registration button **206**A of the first transmission/reception apparatus **201**A was pushed.

The control circuit **211**B of the second transmission/reception apparatus **201**B reads the list of frequencies available for video transmission which is stored in the storage circuit **212**B. Then, it sends this list to the first transmission/reception apparatus **201**A through the communication terminal **207**B.

In the first transmission/reception apparatus **201**A, the list of frequencies available for video transmission which is stored in the storage circuit **212**A is read out, and this list is multiplied by the list of frequencies available for video transmission which has been transmitted from the second transmission/reception apparatus **201**B, and the product is stored in the storage circuit **212**A as a communication frequency list and also transmitted to the communication terminal **207**A.

In the second transmission/reception apparatus **201**B, the communication frequency list transmitted from the first transmission/reception apparatus **201**A is stored in the storage circuit **212**B.

Next, in FIG. **5**, it is assumed that a video transmission request signal from an external apparatus is input to the external apparatus control terminal **208**A of the first transmission/reception apparatus **201**A while a video signal from an external apparatus is input to the video input terminal **204**A. At this time, the control circuit **211**A reads the communication frequency list which is stored in the storage circuit **212**A. Simultaneously, the control circuit **211**A sets the attenuation of the variable attenuator **218**A at the maximum and, thereafter, operates the RF converter **202**A.

Further, the control circuit **211**A rapidly changes the RF frequency of the RF converter **202**A, within the range of the read communication frequency list, according to the frequency changing order such that the frequency changes in one direction, i.e., from the higher frequency to the lower frequency or from the lower frequency to the higher frequency as shown by the first column (the left column) of table 2 and, further, when reaching the end of the communication frequency list, the frequency is returned to the beginning of the list. After the power spectrum is spread by changing the frequency in this way, the control circuit **211**A reduces the attenuation of the variable attenuator **218**A to start transmission.

The frequency changing order shown in table 2 is predetermined between the first transmission/reception apparatus **201**A and the second transmission/reception apparatus **201**B.

Further, the communication frequency is changed according to the timing of the horizontal synchronous signal or the vertical synchronous signal of the video signal input through the video input terminal **204**A. Further, the synchronous signal to be used is extracted from the video signal by the comparator **214**A.

In order to prevent influences on other radio apparatuses and utilize the wave effectively, it is necessary to set the RF power density per unit band width at a level lower than the minute-power level **304** shown in FIG. **6**. Therefore, the control circuit **211**A obtains the band width of the use frequency and diffusion coefficient of the power spectrum from the communication frequency list, and thereby controls the attenuation of the variable attenuator **218**A so as to keep the RF power density per unit band width constant.

On the other hand, in FIG. **5**, when a video reception request signal from an external apparatus is input to the external apparatus control terminal **208**B of the second transmission/reception apparatus **201**B, the control circuit **208**B of the second transmission/reception apparatus reads the communication frequency list which is stored in the storage circuit **212**B, and operates the RF tuner **203**B.

Further, the control circuit **211**B of the second transmission/reception apparatus **201**B rapidly changes the reception frequency of the RF tuner **203**B within the read communication frequency list, according to the frequency changing order shown in the first column of table 2, by using, as the frequency switching timing, the pseudo synchronous timing generated in the control circuit **211**B, thereby receiving the RF signal from the first transmission/reception apparatus **201**A.

In the period immediately after the second transmission/reception apparatus **201**B has started reception, the synchronous timing of the video signal at the transmitting end and the pseudo synchronous timing at the receiving end do not necessarily coincide with each other. Further, the transmission frequency and the receiving frequency do not necessarily temporally coincide with each other. Therefore, no signal appears in the video output of the RF tuner **203**B of the second transmission/reception apparatus nor in the output of the comparator **225**B.

Accordingly, the control circuit **211**B of the second transmission/reception apparatus **201**B tries to detect the transmission signal from the first transmission/reception apparatus **201**A by successively changing the pseudo synchronous

timing and the start time of the time table of the reception frequency, while monitoring the output of the comparator **225**B.

Since the synchronous timing of the video signal from the first transmission/reception apparatus **201**A and the time cycle of the time table of the transmission frequency are constant, the second transmission/reception apparatus **201**B succeeds in detecting the transmission signal from the first transmission/reception apparatus **201**A after predetermined trials.

When detection of the transmission signal from the first transmission/reception apparatus **201**A has succeeded, the control circuit **211**B of the second transmission/reception apparatus **201**B changes the synchronous timing of the received video signal extracted by the comparator **126** to the pseudo synchronous timing.

Further, in the second transmission/reception apparatus **201**B, when detection of the transmission signal from the first transmission/reception apparatus **201**A has been completed, the control circuit **211**B reads the communication frequency list stored in the storage circuit **212**B, and sets the attenuation of the variable attenuator **218**B to the maximum and, thereafter, operates the RF converter **202**B.

Further, the control circuit **211**B rapidly changes the RF frequency of the RF converter within the range of the read communication frequency list, according to the frequency changing order such that the frequency is changed in one direction, i.e., from the higher frequency to the lower frequency or from the lower frequency to the higher frequency as shown in the second column of table 2 and, further, when reaching the end of the communication frequency list, the frequency is returned to the beginning of the list. Furthermore, the frequency change is carried out by using the frequency time table using frequencies which are always different from the transmission frequency of the first transmission/reception apparatus and are not the image frequency of the reception frequency. After spreading the power spectrum by the frequency change, the control circuit **211**B reduces the attenuation of the variable attenuator **218**B to start transmission.

The frequency changing order shown in table 2 is predetermined between the first transmission/reception apparatus **201**A and the second transmission/reception apparatus **201**B.

Further, the communication frequency is changed according to the synchronous timing of the video signal transmitted from the first transmission/reception apparatus **201**A which has completed the detection.

In order to prevent influences on other radio apparatuses and effectively utilize the wave, it is necessary to set the RF power density per unit band width for transmission to a level lower than the minute-power level **304** shown in FIG. **3**. Therefore, the control circuit **211**B obtains the band width of the use frequency and the diffusion coefficient of the power spectrum from the communication frequency list, and thereby controls the attenuation of the variable attenuator **218**B so as to keep the RF power density per unit band width constant.

On the other hand, in the first transmission/reception apparatus **201**A, the RF tuner **203**A is operated when a predetermined period of time has passed after starting the transmission.

Further, the control circuit **211**A of the first transmission/reception apparatus **201**A rapidly changes the reception frequency of the RF tuner **203**A within the range of the communication frequency list, according to the frequency changing order shown in the second column of table 2, by using, as the frequency changing timing, the synchronous timing of the video signal being transmitted, thereby receiving the RF signal from the second transmission/reception apparatus **201**B.

In the period immediately after the first transmission/reception apparatus **201**A has started reception, the transmission frequency and the reception frequency do not necessarily temporally coincide with each other. Therefore, no signal appears in the video output of the RF tuner **203**A of the first transmission/reception apparatus nor in the output of the comparator **225**A.

Accordingly, the control circuit **211**A of the first transmission/reception apparatus **201**A tries to detect the transmission signal from the second transmission/reception apparatus **201**B by successively changing the start time of the time table of the reception frequency, while monitoring the output of the comparator **225**A.

Since the time table cycle of the transmission frequency of the second transmission/reception frequency is constant, the first transmission/reception apparatus succeeds in detecting the transmission signal from the second transmission/reception apparatus after predetermined trials.

In this way, duplex communication between the first and second transmission/reception apparatuses is realized.

Generally, the reception level of radio communication using a wide frequency band is affected by the multi-path and the frequency response of the transmission/reception antenna, and thereby varies significantly like the reception level **406** shown in FIG. **7**. At a frequency the reception level of which is lower than the communication threshold level **407**, no video signal can be reproduced.

When duplex communication between the first and second transmission/reception apparatuses is realized as described above, these apparatuses can exchange information about the frequency the reception level of which is lower than the communication threshold level due to the influences of the multi-path and the frequency response of the transmission/reception antenna.

In the second transmission/reception apparatus **201**B, a pseudo video signal is generated by the control circuit **211**B, and the information about the frequency lower than the communication a threshold level is superposed on the data **605** of the video signal in the vertical blanking period by using the compositor **216** to be returned to the first transmission/reception apparatus **201**A. Further, in the second transmission/reception apparatus **201**B, a second communication frequency list is formed by duplicating the communication frequency list, and the frequencies lower than the communication threshold level are removed from the second communication frequency list, and then the second communication frequency list is stored in the storage circuit **212**B.

In the first transmission/reception apparatus **201**A, the information about the frequencies lower than the communication threshold level, which has been returned, is confirmed, and a second communication frequency list is formed by duplicating the communication frequency list. Then, the frequencies lower than the communication threshold level, which have been returned, are removed from the second list, and the second list is stored in the storage circuit **212**A and, simultaneously, transmission using this second communication frequency list is started.

In the second transmission/reception apparatus **201**B, since the communication frequency list has been changed, the transmission signal from the first transmission/reception apparatus which has been detected is lost. However, after a predetermined period of time, it resumes detection of the transmission signal from the first transmission/reception

apparatus and the above-described series of responding operations by using the second communication frequency list which has been formed.

Also in the first transmission/reception apparatus, since the communication frequency list has been changed, the transmission signal from the second transmission/reception apparatus which has been detected is lost. However, after a predetermined period of time, it resumes detection of the transmission signal from the second transmission/reception apparatus by using the second communication frequency list which has been formed, whereby duplex communication is reestablished.

Further, when the frequencies lower than the communication threshold level are changed because the position of the first or second transmission/reception apparatus is changed during it is used or the status of the multi-path is changed, the first transmission/reception apparatus **201**A which detects it changes the communication frequency list to be used from the second communication frequency list to the original communication frequency list, and starts transmission.

In the second transmission/reception apparatus, since the communication frequency list has been changed, the transmission signal from the first transmission/reception apparatus which has been detected is lost. However, after a predetermined period of time, the second transmission/reception apparatus changes the communication frequency list to be used from the second communication frequency list to the original communication frequency list, and resumes detection of the transmission signal from the first transmission/reception apparatus and the above-described series of responding operations. Furthermore, with respect to transmission from the self-apparatus, the second transmission/reception apparatus changes the communication frequency list to be used from the second communication frequency list to the original communication frequency list, and starts transmission.

Further, in the first transmission/reception apparatus **201**A, since the communication frequency list has been changed, the transmission signal from the second transmission/reception apparatus which has been detected is lost. However, after a predetermined period of time, the first transmission/reception apparatus **201**A changes the communication frequency list to be used from the second communication frequency list to the original communication frequency list, and resumes detection of the transmission signal from the second transmission/reception apparatus, whereby duplex communication is reestablished.

After the duplex communication using the original communication frequency list has been reestablished since the communication returns into the initial status, the first and second transmission/reception apparatuses newly exchange the information about frequencies lower than the communication threshold level in accordance with the above-described series of processes and operations, and reestablish duplex communication using the second communication frequency list which is updated by using the information.

In the operation of forming and updating the second communication frequency list to be used, as described above, both the first and second transmission/reception apparatuses automatically control the RF power density per unit band width in accordance with the use frequency band width and the diffusion coefficient of the power spectrum.

As described above, in simplex communication, because of the influences of the multi-path and the frequency characteristics of the transmission/reception antenna, a portion of the video signal cannot be reproduced as shown in FIG. **8**(*b*), resulting in degraded usability. However, since duplex communication is realized, communication can be performed without using frequencies lower than the communication threshold level, thereby realizing video transmission without being affected by the multi-path and the frequency characteristics of the transmission/reception antenna as shown in FIG. **8**(*c*).

Further, as described for the first embodiment, generally, in order to prevent influences on other radio apparatuses and effectively utilize the wave, in a radio transmission apparatus using a minute-power wave, an upper limit is set for the electric field strength in a position apart from the apparatus by a predetermined distance. The upper limit is decided according to the degree of influence on another radio apparatus which uses the same frequency band, and the inspection and measurement method is decided on the basis of the system of the radio apparatus which will be influenced. Control of the electric field strength in a position apart by a predetermined distance is realized by controlling the transmission power in the case of using a transmission antenna which is fixed on the apparatus.

Further, although the mutual influence between the radio apparatuses of the system using a single frequency and the mutual influence between the radio apparatuses of the system using a spread spectrum are great, the mutual influence between these systems is small. The transmission apparatus of this third embodiment uses the frequency band of the standard television broadcasting, and the existing other radio apparatus is a television receiver which uses a single frequency.

For the reasons described above, according to the transmission apparatus of this embodiment which uses the frequency band of the standard television broadcasting and spreads the spectrum for transmission, it is possible to realize transmission with a higher output power than that of the conventional system using a single frequency. Further, since the received power increases with the output power, the transmission distance is increased.

Further, in the transmission apparatus of this third embodiment, the frequencies available for video transmission are detected and registered in advance of use. Therefore, in the future, even when digital television broadcasting or mobile communication equipment will use the same frequency band, the video transmission apparatus of this third embodiment can coexist with them.

Further, since PCM transmission of an audio signal is also possible as in the first embodiment, high-definition bidirectional audio transmission is realized.

Further, as in the second embodiment, since the control signal from the external apparatus which is connected to the first and second transmission/reception apparatuses can be superposed on the part of data **605** shown in FIG. **6** to be transmitted bidirectionally, a higher performance video transmission apparatus is realized.

As described above, in the transmission apparatus according to the third embodiment, each of the first and second transmission/reception apparatuses each having the transmission apparatus and the receiving apparatus according to the second embodiment, performs duplex communication according to the frequency changing order such that the frequency is changed in one direction, i.e., from the higher frequency to the lower frequency or from the lower frequency to the higher frequency, within the range of the communication frequency list and, when reaching the end of the frequency list, the frequency returns to the beginning of the frequency list, and by using the frequency time table in which the first and second transmission/reception appara-

fuses always use different frequencies. Therefore, it is possible to realize a high-performance and inexpensive duplex video transmission apparatus which has the television broadcast receiving function, and realizes mutual control between the respective transmission/reception apparatuses.

Further, the communication frequency list which is registered is used when starting communication and, after communication has started, the second communication frequency list obtained by duplicating the registered communication frequency list is used, and the second communication frequency list is appropriately updated by exchanging information about the result of communication, i.e., good or bad, between the above-mentioned two transmission/reception apparatuses, thereby resulting in a video transmission apparatus which solves the influence of the multi-path.

Accordingly, duplex video transmission is realized, and the influence of the multi-path can be solved, and this third embodiment can be applied to a remote-controlled monitor camera for guarding, and the like.

Further, while in this third embodiment the digitized audio signal is subjected to PCM, other compressive coding methods may be employed.

Further, while in this third embodiment the NTSC system is employed as a standard television signal, the PAS system or the SECAM system may be employed.

Embodiment 4

In this fourth embodiment, interception of a minute-power wave is prevented in such a situation that a plurality of transmission apparatuses are used in a multiple dwelling house.

Hereinafter, the fourth embodiment of the present invention will be described by using FIGS. **5**, **6**, and **7**, and table **3**.

This fourth embodiment corresponds to the inventions described in aspects **10** to **12** and aspects **22** to **24** of this application.

FIG. **5** shows the structure of a transmission apparatus according to the fourth embodiment of the invention. FIG. **6** shows a video signal according to the fourth embodiment of the invention. FIG. **7** shows the use status in a multiple dwelling house where the areas of use waves overlap uncertainly, according to the fourth embodiment of the invention. Table 3 shows the frequency changing order and the frequency time table, according to the fourth embodiment of the invention.

TABLE 3

	C→D	D→C	E→F	F→E	A→B	B→A
	f_1	f_{n-1}	f_n	f_{n-2}	f_{n-3}	f_{n-4}
	f_2	f_n	f_1	f_{n-1}	f_{n-2}	f_{n-3}
	f_3	f_1	f_2	f_n	f_{n-1}	f_{n-2}
	f_4	f_2	f_3	f_1	f_n	f_{n-1}
time ↓	f_5	f_3	f_4	f_2	f_1	f_n
	⋮	⋮	⋮	⋮	⋮	⋮
	f_n	f_{n-2}	f_{n-1}	f_{n-3}	f_{n-4}	f_{n-5}
	f_1	f_{n-1}	f_n	f_{n-2}	f_{n-3}	f_{n-4}
	f_2	f_n	f_1	f_{n-1}	f_{n-2}	f_{n-3}
	⋮	⋮	⋮	⋮	⋮	⋮

In FIG. **5**, **520** denotes an ID storage means described in aspect **10**. This ID storage means **520** stores IDs which are given during manufacture, and this means is composed of the communication terminals **207**A and **207**B, the control circuits **211**A and **211**B, and the storage circuits **212**A and **212**B.

Further, **521** denotes an ID inquiry/registration means described in aspect **10**. This ID inquiry/registration means **521** is used for mutual inquiry of IDs with another apparatus which is permitted to have communication, and registration of the ID, in advance of use. This means is composed of the detection/registration buttons **206**A and **206**B, the communication terminals **207**A and **207**B, the control circuits **211**A and **211**B, and the storage circuits **212**A and **212**B.

Further, **522** denotes a frequency setting means described in aspect **11**. This frequency setting means **522** always executes the reception mode before the transmission mode, and detects the frequency time tables of all apparatuses which are performing transmission within the same wave area, and performs transmission by using a frequency time table in which the use frequencies are always different from those of these other apparatuses. This means is composed of the RF tuners **203**A and **203**B, the comparators **225**A and **225**B, the control circuits **211**A and **211**B, and the storage circuits **212**A and **212**B.

Further, **523** denotes a retransmission means described in aspect **11**. After the transmission mode is executed, if a transmission signal from the apparatus which has requested communication cannot be detected even when a predetermined period of time has passed, this retransmission means **523** performs transmission again by using a frequency time table different from the above-described frequency time table. This means is composed of the transmission/reception antennae **219**A and **219**B, the RF tuners **203**A and **203**B, the comparators **225**A and **225**B, the control circuits **211**A and **211**B, and the storage circuits **212**A and **212**B.

Further, **524** denotes an output stop means described in aspect **12**. This output stop means **524** stops output of audio and video when the ID to be permitted to have communication cannot be confirmed in the reception mode. This means is composed of the control circuits **211**A and **211**B, the comparators **225**A and **225**B, the storage circuits **212**A and **212**B, and the audio video output circuits **227**A and **227**B.

In FIG. **5**, the first and second transmission/reception apparatuses **201**A and **201**B have at least the same units and means as those described for the third embodiment and, furthermore, they are constructed so as to perform at least the same operations as those described for the third embodiment.

When the first and second trasmission/reception apparatuses **201**A and **201**B are manufactured, an ID assignment apparatus is connected to the external apparatus connecting terminals **208**A and **208**B, and IDs which are unique to the respective apparatuses are input. When these IDs are input, the control units **211**A and **211**B store these IDs in the storage circuits **212**A and **212**B, respectively.

Further, in the first and second transmission/reception apparatuses **201**A and **201**B, registration of another apparatus to be permitted to have communication is performed as follows. After the first transmission/reception apparatus **201**A and the second transmission/reception apparatus **201**B are connected at the communication terminals **207**A and **207**B, when one of the detection/registration buttons **206**A and **206**B is pushed, the control circuit **211**A outputs an ID request signal to the control circuit **211**B of the second transmission/reception apparatus, through the communication terminal **207**.

Hereinafter, the operation will be described on assumption that the detection/registration button **206**A was pushed.

The control circuit **211**B of the second transmission/receiving apparatus **201**B which has received the ID request signal, reads the ID of the self-apparatus which is stored in the storage circuit **212**B, and transmits this ID to the first transmission/reception apparatus **201**A through the communication terminal **207**B.

The control circuit **211**A of the first transmission/reception apparatus **201**A which has received the ID of the second transmission/reception apparatus **201**B, stores this ID in the storage circuit **212**A as an ID of another apparatus which is permitted to have communication. At the same time, the control circuit **211**A transmits the ID of the self-apparatus to the second transmission/reception apparatus **201**B through the communication terminal **207**A.

The control circuit **212**B of the second transmission/reception apparatus **201**B which has received the ID of the first transmission/reception apparatus **201**A, stores this Id in the storage circuit **212**B as an ID of another apparatus which is permitted to have communication.

Thus, each of the first and second transmission/reception apparatuses **201**A and **201**B has completed registration of another apparatus which is permitted to have communication.

With reference to FIG. **10**, in each of the following pairs, i.e., a transmission/reception apparatus A and a transmission/reception apparatus B, a transmission/reception apparatus C and a transmission/reception apparatus D, and a transmission/reception apparatus E and a transmission/reception apparatus F, registration of the other transmission/reception apparatus, as an apparatus which is permitted to have communication, has been completed. In the figure, at present, C and D, and E and F are performing communication by using the frequency time tables shown in the first to fourth columns of table **3**.

Further, in FIG. **10**, a, b, c, d, e, and f denote the reachable areas of waves from the transmission/reception apparatuses A, B, C, D, E, and F, respectively.

A description will be given of the operation in the case where the transmission/reception apparatus A performs calling and video and audio transmission to the transmission/reception apparatus B and, further, the transmission/reception apparatus B performs responding and video and audio transmission to the transmission/reception apparatus A. The transmission/reception apparatus A and the transmission/reception apparatus B correspond to the transmission/reception apparatus **201**A and the transmission/reception apparatus **201**B shown in FIG. **5**, respectively.

In FIG. **5**, when a video transmission request signal from an external apparatus is input to the external apparatus control terminal **208** of the transmission/reception apparatus **201**A while a video signal from an external apparatus is input to the video input terminal **204**A, the control circuit **211**A reads the communication frequency list which is stored in the storage circuit **212**A, and operates the RF tuner **203**A, thereby executing the reception mode in advance of the transmission mode.

In the reception mode, the control circuit **211**A of the transmission/reception apparatus **201**A rapidly changes the reception frequency of the RF tuner, within the communication frequency list which has been read, according to the frequency changing order shown in the fifth column of table **3**, by using, as the frequency changing time, the pseudo synchronous timing which is generated in the control circuit **211**A, thereby receiving RF signals from other apparatuses which are performing transmission in the same wave area.

As shown in FIG. **10**, around the transmission/reception apparatus A, the transmission/reception apparatuses B and C exist inside the wave reachable area, and the transmission/reception apparatuses D, B, and F exist outside the wave reachable area. Further, around the transmission/reception apparatus B, the transmission/reception apparatuses A and E exist inside the wave reachable area, and the transmission/reception apparatuses C, D, and F exist outside the wave reachable area.

Further, each of the transmission/reception apparatuses C, D, E, and F performing transmission superposes the ID which is unique to the self-apparatus on the part of data **605** of the transmission video signal shown in FIG. **6** and transmits the video signal, in order to mutually detect the other apparatus which is permitted to have communication.

Initially, in the period immediately after the transmission/reception apparatus **201**A has started reception, the synchronous timing of the video signal transmitted from the surrounding transmission/reception apparatus and the pseudo synchronous timing at the receiving end do not necessarily coincide with each other. Further, the transmission frequency and the receiving frequency do not necessarily temporally coincide with each other. Therefore, no signal appears in the video output of the RF tuner **203**A nor in the output of the comparator **225**A.

Accordingly, the control circuit **211**A of the second transmission/reception apparatus **201**A tries to detect transmission signals from surrounding transmission/reception apparatuses by successively changing the pseudo synchronous timing and the start time of the time table of the reception frequency, while monitoring the output of the comparator **225**A.

In the wave reachable area of the transmission/reception apparatus A, the transmission/reception apparatus C is performing transmission by using the frequency time table shown in the first column, i.e., the leftmost column, of table **3**. Since the synchronous timing of the video signal transmitted by the transmission/reception apparatus C and the cycle of the time table of the transmission frequency are constant, the transmission/reception apparatus A succeeds in detecting the transmission signal from the transmission/reception apparatus C after predetermined trials.

When detection of the transmission signal has succeeded, the transmission/reception apparatus A changes the synchronous timing of the received video signal extracted by the comparator **225**A to the pseudo synchronous timing and uses it. At the same time, the apparatus A extracts the part of data **605** shown in FIG. **6** by A using the comparator **225**A, and reads the ID of the transmission/reception apparatus which transmits this signal.

When the read ID is not the apparatus which is permitted to have communication, the frequency time table which is currently used is stored in the storage circuit **212**A, as a list being used by surrounding another group of transmission/reception apparatuses.

The transmission/reception apparatus A continuously tries to detect transmission signals from surrounding transmission/reception apparatuses, to know whether or not there exists still another apparatus performing transmission in the wave reachable area, by successively changing the pseudo synchronous timing and the start time of the time table of the reception frequency, while monitoring the output of the comparator **225**A.

After trying to detect transmission signals while thoroughly changing the pseudo synchronous timing and the start time of the time table of the reception frequency, when it is confirmed that there is no more apparatus than the transmission/reception apparatus C around the transmission/reception apparatus A, the control circuit **211**A of the

apparatus A spreads the power spectrum by rapidly changing the RF frequency of the RF converter 202A by using a list other than the stored list being used by another group, for example, the frequency time table in the third column of table 3 and, thereafter, reduces the attenuation of the variable attenuator 218A to start transmission.

On the other hand, in FIG. 5, when a video reception request signal from an external apparatus is input to the external apparatus control terminal 208B of the transmission/reception apparatus 201B, the control circuit 208B of the transmission/reception apparatus 201B reads the communication frequency list which is stored in the storage circuit 212B, and operates the RF tuner 203B.

Further, the control circuit 211B of the transmission/reception apparatus 201B rapidly changes the reception frequency of the RF tuner 203, within the range of the communication frequency list which has been read, according to the frequency changing order shown in the sixth column of table 3, by using, as the frequency changing timing, the pseudo synchronous timing generated in the control circuit 211B, thereby receiving the RF signal from the transmission/reception apparatus A.

In the period immediately after the transmission/reception apparatus B has started reception, the synchronous timing of the video signal at the transmitting end and the pseudo synchronous timing at the receiving end do not necessarily coincide with each other. Further, the transmission frequency and the receiving frequency do not necessarily temporally coincide with each other. Therefore, no signal appears in the video output of the RF tuner 203B nor in the output of the comparator 225B.

Accordingly, the control circuit 211B of the transmission/reception apparatus 201B tries to detect the transmission signal from the transmission/reception apparatus A by successively changing the pseudo synchronous timing and the start time of the time table of the reception frequency while monitoring the output of the comparator 225B.

Now it is assumed that, in the wave reachable area of the transmission/reception apparatus B, both of the transmission/reception apparatus A and the transmission reception apparatus B perform transmission by using the frequency time table shown in the third column of table 3. Since the synchronous timings of the video signals transmitted from the transmission/reception apparatuses A and E and the cycle of the time table of the transmission frequency are constant, the transmission/reception apparatus B detects the transmission signals from the transmission/reception apparatuses A and E after predetermined trials.

When the transmission/reception apparatus B has succeeded in detecting the transmission signals, it tries to extract the synchronous timings of the received video signals by using the comparator 225B. However, since the received signals from the transmission/reception apparatuses A and B overlap and interfere with each other, a synchronous signal of normal cycle is not obtained. Accordingly, the transmission/reception apparatus B does not perform transmission for responding but enters into the operation to detect another transmission signal.

In the transmission/reception apparatus A, although the reception mode is continued by the RF tuner after transmission has been started, the RF tuner cannot detect a response signal from the transmission/reception apparatus B which has requested communication even when a predetermined period of time has passed. Therefore, the transmission/reception apparatus A resumes transmission by using a frequency time table which is different from the list being used by another group and different from the list which is currently being used, for example, the frequency time table shown in the fifth column of table 3.

Since the transmission/reception apparatus B continues detection of another transmission signal, it normally detects a transmission signal from the transmission/reception apparatus A which uses a frequency time table different from that of the transmission/reception apparatus E.

When the transmission/reception apparatus B has succeeded in detection, it changes the synchronous timing of the received video signal extracted by the comparator 225B to the pseudo synchronous timing and uses it. Simultaneously, the transmission/reception apparatus B extracts the part of data 605 shown in FIG. 6 by using the comparator 225B, and reads the ID of the transmission/reception apparatus which transmits this signal.

Then, the transmission/reception apparatus B confirms, from the read ID, that the signal currently being received is a signal from the transmission/reception apparatus A which is permitted to have communication.

Further, in the transmission/reception apparatus B, when detection of the transmission signal from the transmission/reception apparatus A and confirmation of the ID have been completed, the control circuit 211B reads the communication frequency list stored in the storage circuit 212B, and sets the attenuation of the variable attenuator 218B at the maximum and, thereafter, operates the RF converter 202B.

Furthermore, the control circuit 211B rapidly changes the RF frequency of the RF converter 202B, within the range of the read communication frequency list, by using, for example, the frequency time table shown in the sixth column of table 3, thereby spreading the power spectrum. Thereafter, the control circuit 211B reduces the attenuation of the variable attenuator 218B to start transmission.

Further, the communication frequency is changed according to the synchronous timing of the video signal transmitted from the transmission/reception apparatus A which has completed detection.

On the other hand, since the transmission/reception apparatus A continues the reception mode by using the RF tuner, it detects a response signal from the transmission/reception apparatus B.

As shown in table 3, the response signal from the transmission/reception apparatus B is different from the frequency time table which is being used by another group of transmission/reception apparatuses in the wave reachable area of the transmission/reception apparatus A and, therefore, favorable reception is achieved.

When the transmission/reception apparatus A has succeeded in detecting the transmission signal, it tries to extract the response signal which is superposed on the received video signal. Since a normal response signal is confirmed from the received video signal which is in favorable reception state, the transmission/reception apparatus A transmits a response indicating "duplex communication succeeded" by superposing it on the video signal which is already being transmitted.

When the transmission/reception apparatus B confirms the response signal indicating "duplex communication succeeded", it fixes the frequency time table to be used thereafter to assure the transmission path.

In the above-mentioned process, when the frequency time table used by the transmission/reception apparatus B coincides with, for example, the frequency time table in the first column of table 3, the transmission/reception apparatus A cannot confirm the response signal from the apparatus B and, therefore, it does not transmit the response signal indicating "duplex communication succeeded". Since the

transmission/reception apparatus B cannot confirm the response signal indicating "duplex communication succeeded" from the transmission/reception apparatus A even when a predetermined period of time has passed, it starts transmission by using still another frequency time table, for example, the frequency time table in the sixth column of table 3, thereby returning into the above-described favorable reception state.

Further, in the above-described process, when the group of transmission/reception apparatuses C and D and the group of transmission/reception apparatuses A and B use different communication frequency lists, no mutual interference occurs substantially because mutual interference decreases according to the ratio of time in which these groups use the same frequency simultaneously, and this case is identical to the state where no transmission/reception apparatus group performing transmission exists in the neighborhood, resulting in favorable communication.

Thus, radio interference is prevented in a multiple dwelling house in which the used wave areas may overlap uncertainly.

Further, in the above-described process, there is a possibility that the transmission/reception apparatuses A and B detect the transmission signals from the transmission/reception apparatuses C and E, respectively. However, when it cannot be confirmed that the ID which is superposed on the received video signal is transmitted from the other apparatus which is permitted to have communication, no audio and video signals are output from the audio video output circuits **227**A and **227**B shown in FIG. **5**.

Thereby, regardless of the user's intention, interception can be prevented.

As described above, according to the transmission apparatus of the fourth embodiment, in the transmission apparatus according to the second or third embodiment, an ID which is given to the apparatus during manufacture is stored, and the apparatus performs mutual inquiry of IDs with another apparatus to be permitted to have communication and registers the ID, in advance of use. Therefore, it is possible to realize a video transmission apparatus which solves radio interference and prevents interception in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, the reception mode is always executed in advance of the transmission mode to detect the frequency time tables of all the apparatuses performing transmission in the same wave area, and transmission is performed by using a frequency time table the use frequency of which is always different from those of these apparatuses. If a transmission signal from the other apparatus which has requested communication cannot be detected even when a predetermined period of time has passed after executing the transmission mode, retransmission is performed by using a frequency time table which is different from the above-described frequency time table. Therefore, it is possible to realize a video transmission apparatus which solves ratio interference in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Further, in the reception mode, when the ID which is permitted to have communication cannot be confirmed, no audio and video signals are output. Therefore, it is possible to realize a video transmission apparatus which prevents interception in a multiple dwelling house in which the use wave areas may overlap uncertainly.

Accordingly, in a multiple dwelling house in which the use wave areas may overlap uncertainly, radio interference is solved and interception is prevented, and therefore, the transmission apparatus can be applied to an interior wireless terminal of a front-door visual phone or a visual telephone.

While in this fourth embodiment a digitized audio signal is subjected to PCM, other compressive coding methods may be used.

Further, while in this fourth embodiment the NTSC system is used as a standard television signal, the PAL system or the SECAM system may be used.

APPLICABILITY IN INDUSTORY

According to a transmission apparatus of aspect **1**, a relay station is provided between a master station and a slave station which transmit video or audio by utilizing a minute-power wave, a transmission signal from the master station includes information indicating the address of the slave station and a frequency at which the self-station receives a signal from the relay station, the relay station modulates the frequency of the wave received from the master station to a different frequency and outputs it, and the slave station recognizes that the transmission signal is a signal directed to the self-station and then modulates the minute-power wave to the frequency specified by the relay station, thereby establishing a transmission path between the master station and the slave station. Therefore, this apparatus enables transmission in the case where the distance between the master station and the slave station exceeds the reachable range of the minute-power wave.

According to a transmission apparatus of aspect **2**, in the transmission apparatus of aspect **1**, a standard television signal is used as the transmission signal in the forward path from the master station to the slave station, and a PCM audio signal and the information indicating the address of the slave station and the reception frequency specified by the self-station are superposed on a video signal during the vertical blanking period of the video signal. Therefore, this apparatus enables transmission in the case where the distance between the master station and the slave station exceeds the reachable range of the minute-power wave. Further, when the standard television signal is used as the transmission signal, the PCM audio signal and the information indicating the address of the slave station and the reception frequency specified by the self-station can be superposed to the transmission signal.

According to a transmission apparatus of aspect **3**, this transmission apparatus is provided with a transmitter having an RF converter which generates a standard television signal and a receiver having an RB tuner which receives the standard television signal, frequencies which can be used for video transmission are detected within the reception band of the RF tuner in advance of use, the detected frequencies are registered in both of the transmitter and the receiver, and the power spectrum is spread by changing the frequency within the range of the communication frequency list to perform spread spectrum communication. Therefore, it is possible to obtain a transmission apparatus which reduces the influence of multi-path.

According to a transmission apparatus of aspect **4**, in the transmission apparatus of aspect **3**, the transmission power is automatically changed in accordance with the use frequency band width so as to keep the power density per unit band width constant. Therefore, this apparatus enables transmission at a minute-power wave level which does not interfere with reception of an existing radio communication apparatus.

According to a transmission apparatus of aspect **5**, in the transmission apparatus of aspect **3** or **4**, the frequency during

the communication is changed in synchronization with the synchronous timing of the video signal. Therefore, disordering of the video signal due to the frequency change can be reduced, resulting in video transmission with improved image quality.

According to a transmission apparatus of aspect 6, in the transmission apparatus according to any of aspects 3 to 5, a control signal is transmitted by superposing it on the video signal in the blanking period. Therefore, it is possible to control the operation of the receiving apparatus from the transmission apparatus.

According to a transmission apparatus of aspect 7, in the transmission apparatus according to any of aspects 3 to 6, an audio signal is subjected to PCM, and the PCM audio signal is transmitted by superposing it on the video signal in the blanking period. Therefore, noise in the audio signal due to the frequency change is removed, resulting in transmission with improved sound quality.

According to a transmission apparatus of aspect 8, first and second transmission/reception apparatuses are constructed by using the transmission apparatus according to any of aspects 3 to 8, and the frequency is changed within the communication frequency list, from the higher frequency to the lower frequency or in the reverse order, by using different frequency time tables for the first and second transmission/reception apparatuses. Therefore, mutual control is realized between the respective transmission/reception apparatuses.

According to a transmission apparatus of aspect 9, in the transmission apparatus of aspect 8, the previously registered communication frequency list is used when starting the communication and, after communication has been started, a second communication frequency list which is obtained by duplicating the registered communication frequency list is desirably updated according to the information as to whether the communication is good or bad. Therefore, the influence of multi-path is solved.

According to a transmission apparatus of aspect 10, in the transmission apparatus according to any of aspects 3 to 9, an ID which is given to the apparatus during manufacture is stored, and mutual inquiry of IDs is performed with another transmission apparatus which is permitted to have communication in advance of use, and then the ID is registered. Therefore, radio interference between the transmission apparatuses is avoided.

According to a transmission apparatus of aspect 11, in the transmission apparatus of aspect 10, the reception mode is executed in advance of the transmission mode to detect the frequency time tables of all other transmission apparatuses which are performing transmission within the same wave area, and transmission is performed by using a frequency time table the use frequency of which is always different from those of these other transmission apparatuses. When a transmission signal from another apparatus which has requested communication cannot be detected even when a predetermined period of time has passed after starting the transmission mode, retransmission is performed by using a frequency time table different from the frequency time table which has been used. Therefore, radio interference between the transmission apparatuses is avoided.

According to a transmission apparatus of aspect 12, in the transmission apparatus of aspect 10 or 11, when the ID which is permitted to have communication cannot be confirmed in the reception mode, output of audio or video is stopped. Therefore, interception is avoided.

According to a transmission method of aspect 13, a relay station is provided between a master station and a slave station which transmit video or audio by utilizing a minute-power wave, a transmission signal from the master station includes information indicating the address of the slave station and a frequency at which the self-station receives a signal from the relay station, the relay station modulates the frequency of the wave received from the master station to a different frequency and outputs it, and the slave station recognizes that the transmission signal is a signal directed to the self-station and then modulates the minute-power wave to the frequency specified by the relay station, thereby establishing a transmission path between the master station and the slave station. Therefore, this method enables transmission in the case where the distance between the master station and the slave station exceeds the reachable range of the minute-power wave.

According to a transmission method of aspect 14, in the transmission method of aspect 13, a standard television signal is used as the transmission signal in the forward path from the master station to the slave station, and a PCM audio signal and the information indicating the address of the slave station and the reception frequency specified by the self-station are superposed on a video signal during the vertical blanking period of the video signal. Therefore, this method enables transmission in the case where the distance between the master station and the slave station exceeds the reachable range of the minute-power wave. Further, when the standard television signal is used as the transmission signal, the PCM audio signal and the information indicating the address of the slave station and the reception frequency specified by the self-station can be superposed o the transmission signal.

According to a transmission method of aspect 15, this method uses a transmitter having an RF converter which generates a standard television signal and a receiver having an RF tuner which receives the standard television signal, frequencies which can be used for video transmission are detected within the reception band of the RF tuner in advance of use, the detected frequencies are registered in both of the transmitter and the receiver, and the power spectrum is spread by changing the frequency within the range of the communication frequency list to perform spread spectrum communication. Therefore, it is possible to obtain a transmission method which reduces the influence of multi-path.

According to a transmission method of aspect 16, in the transmission method of aspect 15, the transmission power is automatically changed in accordance with the use frequency band width so as to keep the power density per unit band width constant. Therefore, this method enables transmission at a minute-power wave level which does not interfere with reception of an existing radio communication apparatus.

According to a transmission apparatus of aspect 17, in the transmission method of aspect 15 or 16, the frequency during the communication is changed in synchronization with the synchronous timing of the video signal. Therefore, disordering of the video signal due to the frequency change can be reduced, resulting in video transmission with improved image quality.

According to a transmission method of aspect 18, in the transmission method according to any of aspects 15 to 17, a control signal is transmitted by superposing it on the video signal in the blanking period. Therefore, it is possible to control the operation of the receiving apparatus from the transmission apparatus.

According to a transmission method of aspect 19, in the transmission method according to any of aspects 15 to 18, an audio signal is subjected to PCM, and the PCM audio signal is transmitted by superposing it on the video signal in the

blanking period. Therefore, noise in the audio signal due to the frequency change is removed, resulting in transmission with improved sound quality.

According to a transmission method of aspect **20**, first and second transmission/reception apparatuses each performing the transmission method according to any of aspects **15** to **19** are provided, and the frequency is changed within the communication frequency list, from the higher frequency to the lower frequency or in the reverse order, by using different frequency time tables for the first and second transmission/reception apparatuses. Therefore, mutual control is realized between the respective transmission/reception apparatuses.

According to a transmission method of aspect **21**, in the transmission method of aspect **20**, the previously registered communication frequency list is used when starting the communication and, after communication has been started, a second communication frequency list which is obtained by duplicating the registered communication frequency list is desirably updated according to the information as to whether the communication is good or bad. Therefore, the influence of multi-path is solved.

According to a transmission method of aspect **22**, in the transmission method according to any of aspects **15** to **21**, an ID which is given to the apparatus during manufacture is stored, and mutual inquiry of IDs is performed with another transmission apparatus which is permitted to have communication in advance of use, and then the ID is registered. Therefore, radio interference between the transmission apparatuses is avoided.

According to a transmission method of aspect **23**, in the transmission method of aspect **22**, the reception mode is executed in advance of the transmission mode to detect the frequency time tables of all other transmission apparatuses which are performing transmission within the same wave area, and transmission is performed by using a frequency time table the use frequency of which is always different from those of these other transmission apparatuses. When a transmission signal from another apparatus which has requested communication cannot be detected even when a predetermined period of time has passed after starting the transmission mode, retransmission is performed by using a frequency time table different from the frequency time table which has been used. Therefore, radio interference between the transmission apparatuses is avoided.

According to a transmission method of aspect **24**, in the transmission method of aspect **22** or **23**, when the ID which is permitted to have communication cannot be confirmed in the reception mode, output Of audio or video is stopped. Therefore, interception is avoided.

The invention claimed is:

1. A transmission apparatus comprising:

a master station for transmitting and receiving a video or audio transmission signal by utilizing a first minute-power wave, said transmission signal comprising slave station address information and master station receiving frequency information indicating a frequency at which a master station can receive a signal from a relay station;

a slave station for transmitting and receiving a video or audio transmission signal utilizing a second minute-power wave; and

a relay station located between the master station and the slave station, said master and slave stations located apart from each other by a distance longer than the reachable range of a first minute-power wave, wherein

said relay station is for receiving a first minute-power signal (f1) from modulating at the master station, modulating it to a different frequency (f2), and transmitting the modulated first minute-power signal to the slave station;

said relay station is for receiving from the master station, return frequency information (f0) as part of a first minute-power signal, demodulating a portion of a second minute-power signal received from the slave station, modulating the demodulated portion at the master station return frequency (f0), and transmitting the modulated portion of the second minute-power signal to the master station, thereby establishing a return transmission path between the relay station and the master station;

said relay station is for transmitting information about a relay station receiving frequency at which the relay station receives a signal from the slave station;

said slave station is for recognizing that a transmission signal is a signal directed to said slave station; and

said slave station is for modulating and transmitting a response signal comprising video or audio information at said relay station receiving frequency, thereby establishing a transmission path between the master station and the slave station.

2. The transmission apparatus as described in claim **1**, wherein:

said master station is for transmitting a transmission signal comprising:

a standard television signal in the forward path from the master station to the slave station; and

a PCM audio signal and the information indicating the address of the slave station and the reception frequency specified by the slave station superposed on a video signal during the vertical blanking period of the video signal.

3. A transmission method for mutually transmitting video and audio transmission signals between a master station and a slave station by utilizing a minute-power wave, comprising:

locating a relay station between the master station and the slave station which are located apart from each other by a distance longer than the reachable range of the minute-power wave;

generating a transmission signal from the master station comprising, in addition to original audio or video information, information indicating an address of the slave station, and information indicating a frequency at which the master station receives a signal from the relay station;

modulating by said relay station the frequency of the minute-power wave received from the master station to a different frequency and outputting said different frequency;

transmitting by said relay station information about a frequency at which the relay station receives a signal from the slave station; and

modulating by the slave station the minute-power wave to the frequency specified by the relay station and transmitting the video or audio, thereby establishing a transmission path between the master station and the slave station, when the slave station recognizes that the transmission signal is a signal directed to the slave station.

4. The transmission method as described in claim **3**, further comprising:

using a standard television signal as the transmission signal in the forward path from the master station to the slave station; and

superposing a PCM audio signal and the information indicating the destination station and the reception frequency specified by the slave station on a video signal during the vertical blanking period of the video signal.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,209,746 B1
APPLICATION NO. : 09/423356
DATED : April 24, 2007
INVENTOR(S) : Hideki Kirino and Tetsuo Hiraga

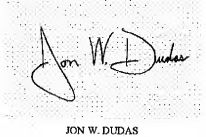
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page:
(86) Section 371(c)(1), (2), (4) Date: delete "Jun. 21, 2000" and insert --Jan. 21, 2000--.

Column 38, line 2, delete "modulating at".

Signed and Sealed this

Seventh Day of August, 2007



JON W. DUDAS
Director of the United States Patent and Trademark Office